# PicSight-GigE user manual

## Documentation for Leutron Vision GigE Vision cameras

**Leutron Vision**

# PicSight-GigE user manual: Documentation for Leutron Vision GigE Vision cameras

Leutron Vision

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# General information

## Scope of the manual

This manual introduces the PicSight-GigE camera family and covers all common aspects of work with these cameras. Technical specifications and other model-specific data are listed in an appendix (Appendix A, *Technical specifications for individual models* [p. 293]).

## Related documents

- Simplon getting started — Simplon package overview, installation instructions and quick start guide.
- Product datasheets — list of Leutron Vision camera models with links to their respective data-sheets.
- PicSight-Smart Library API programmer's guide — overview and tutorial of the PicSight-Smart Library API library.
- CheckSight-II user manual — user manual for our CheckSight-II smart camera series.
- CheckSight user manual — user manual for our CheckSight smart camera series.
- Simplon tools — overview and documentation of various tools delivered with the Simplon package.

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# Where do I find…?

The following points could help you to search for some important piece of information within this manual:

- Install and test the camera quickly: Chapter 1, *Quick start* [p. 13]
- Technical specifications: Appendix A, *Technical specifications for individual models* [p. 293]
- Connector pinout description: Section 3.8, “Connector and cable description” [p. 44]
- Simplon package installation instructions: Section 4.1, “Simplon” [p. 50]
- Camera setup and configuration (incl. firmware update): Chapter 5, *Initial configuration and preparation* [p. 65]
- Detailed documentation of camera features: Chapter 6, *Camera features and their control* [p. 96]
- Operating modes (GigE Vision vs. legacy mode): Section 2.5, “GigE Vision compatible and legacy boot modes” [p. 25]
- GenICam GigE Vision and other industrial standards: Standards' introduction in Simplon getting started
- Release notes (revision history): PicSight-GigE & PicSight-Smart revision history
- Looking for something else? Try Table of contents.

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# Important information

## Precautions

*Not respecting these precautions can lead to injury, camera damage, incorrect camera performance and loss of warranty.*

- **Read the documentation.** Read the camera documentation before using the camera.
- **Camera power.** Incorrect input power can damage the camera. Follow guidelines in Section 3.7.1, “DC power input” [p. 40]. Do not reverse power polarity. Do not connect or disconnect other cables when the camera power is on.
- **Opening the camera.** Do not open the camera. Do not let liquid, dust, flammable or metallic material to get inside the camera.
- **Environment.** Always use the camera in conditions meeting the requirements specified in Section 2.7, “Environmental requirements” [p. 27]
- **Cleaning the sensor window.** Avoid cleaning the sensor window if possible. Keep lens cap closed as long as no lens is attached, avoid touching the sensor. If necessary, clean the sensor window using compressed air. If further cleaning is required, use lint-free, ESD-safe cloth wiper. Avoid cloth that could generate static charge or that could scratch the window. The camera should be cleaned in an ESD-safe area, the person performing cleaning should be earthed.
- **Electromagnetic fields.** Keep the camera away from strong electromagnetic fields. Avoid static charging, handle the camera in ESD protected area.
- **Connectors.** Take care when handling the camera so that no damage can be done to the connectors. Prevent foreign objects in the connectors.
- **Transporting the camera.** Always transport the camera in its original packaging.

## Covered camera models

This manual covers the current “AS” series of PicSight-GigE and PicSight-Smart cameras (PicSight-GigE-AS/PicSight-Smart-S) as well as the legacy “AR” series (PicSight-GigE-AR/PicSight-Smart-R).

Older camera series (prior to the “AR” line) are not covered, do not use this manual for those cameras.

The described feature interface corresponds with cameras' firmware version 2.x, providing pure GigE Vision interface. Cameras featuring firmware version of the 1.x line might differ in some features, many features wouldn't be available at all.

## Licensing information

The Simplon package and/or the software included in the cameras is using following 3rd party software components:

- GenICam GenApi reference implementation — distributed under the GenICam license by the GenICam committee. The copyright is held by the GenICam committee and its contributing members working group (which includes Leutron Vision). The package as well as the license is

available from www.genicam.org[1]. The GenICam GenApi reference implementation in turn uses Apache Xalan-C++ and Xerces-C++ libraries (Apache license, www.apache.org[2]) and the modified MathParser librariy (LGPL license, kirya.narod.ru/mathparser.html[3]).

- zlib compression library: available from www.zlib.net[4] under zlib license.
- lwIP (lightweight TCP/IP stack): available from savannah.nongnu.org/projects/lwip[5] under modified BSD license. The copyright © is held by Swedish Institute of Computer Science.
- The Independent JPEG Group's JPEG software (libjpeg): available from www.ijg.org[6] (Independent JPEG Group).
- OpenCV: available from opencv.willowgarage.com[7] under BSD license.

[1] http://www.genicam.org
[2] http://www.apache.org/
[3] http://kirya.narod.ru/mathparser.html
[4] http://www.zlib.net/
[5] http://savannah.nongnu.org/projects/lwip/
[6] http://www.ijg.org/
[7] http://opencv.willowgarage.com/

# 1. Quick start

This chapter is intended to help users wanting to start quickly with basic usage of the cameras, without studying the entire documentation. The information in this chapter duplicates information in the following parts of the manual. Whenever in doubt, please refer to the corresponding chapters of the manual, providing detailed description of given problems.

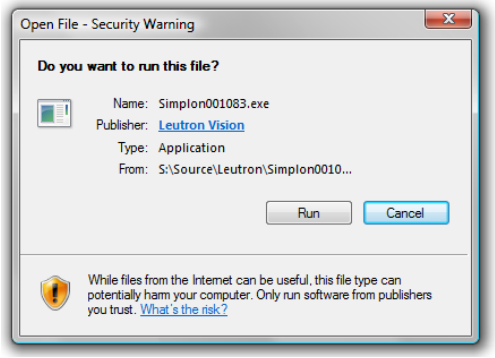
## 1.1. Simplon installation — quick guide for Windows

Following points guide you quickly through Simplon installation under Windows. If in doubts, if you need detailed instructions or if installing in another operating system, refer to full Simplon installation description.

Now let's walk through the installation procedure:

1. Prepare the installation media. The software should be installed by a user with administrator rights.
   - If you have the installation CD, insert it in the CD-ROM drive and wait until installation starts.
   - If you have downloaded the installer from our website[1], execute it.

2. Depending on security adjustments of your system and whether you are running the installer from a local disk or a network share, you might get following security warning. Simply proceed clicking Run.


Open File - Security Warning
Do you want to run this file?
Name: Simplon001083.exe
Publisher: Leutron Vision
Type: Application
From: S:\Source\Leutron\Simplon0010...
Run
Cancel
While files from the Internet can be useful, this file type can potentially harm your computer. Only run software from publishers you trust. What's the risk?

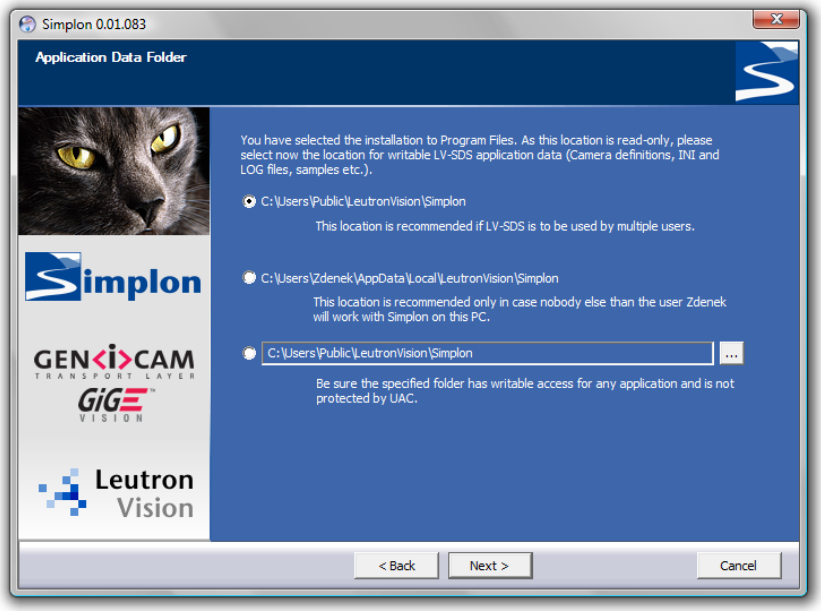
3. The installer welcomes you with following screen, click Next.

4. Next screen is the license agreement. Please read carefully the license text and if you agree, click the I Agree button to proceed with installation.

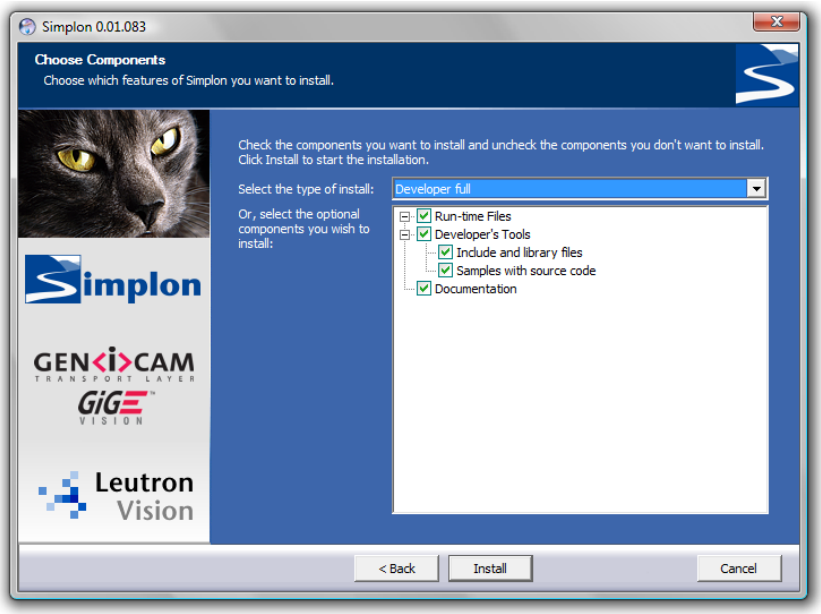
5. Next the installer asks you about the location where to install Simplon. The default location will do well in most cases. Keep it or select another preferred location and click Next.

6. If running Windows Vista or newer Windows version, the default software installation directory (`C:\Program Files`) is read only. The installer will ask you where to put the application data requiring write access (the dialog will not appear on Windows XP). Select a desired location and click Next.

[1] http://www.leutron.com/support-downloads/download-area/


Simplon 0.01.083
Application Data Folder
You have selected the installation to Program Files. As this location is read-only, please select now the location for writable LV-SDS application data (Camera definitions, INI and LOG files, samples etc.).
C:\Users\Public\LeutronVision\Simplon
This location is recommended if LV-SDS is to be used by multiple users.
C:\Users\Zdenek\AppData\Local\LeutronVision\Simplon
This location is recommended only in case nobody else than the user Zdenek will work with Simplon on this PC.
C:\Users\Public\LeutronVision\Simplon
Be sure the specified folder has writable access for any application and is not protected by UAC.
Simplon
GEN<i>CAM
TRANSPORT LAYER
GiGE VISION
Leutron Vision
< Back
Next >
Cancel

7. In the next step you can select the Simplon components to install. Note that for testing the cameras, the “runtime” components suffice. However, for programming with Simplon you need to make sure the Developer's tools are installed as well. When finished with the selection, click Install.




8. After starting the installation, the selected components will be installed to your computer. The installer will inform you about the progress.

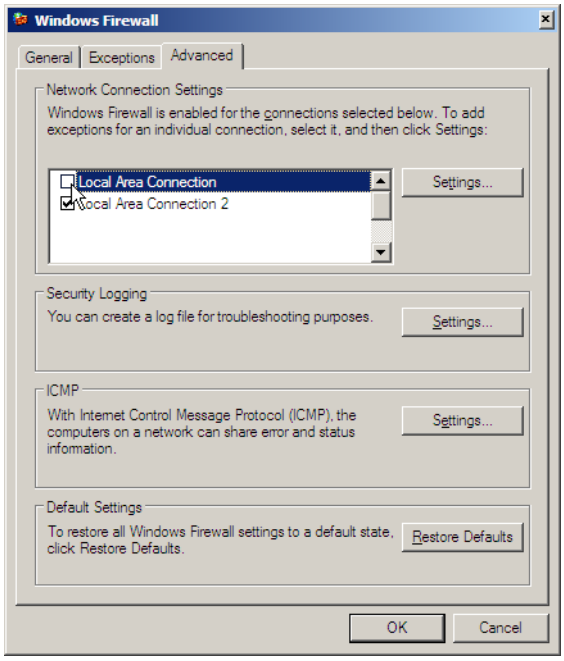
9. When completed, the installer displays the final dialog. Keep the default option (Reboot now) and click Finish. After rebooting, Simplon is ready to use.

## 1.2. Prepare the camera(s)

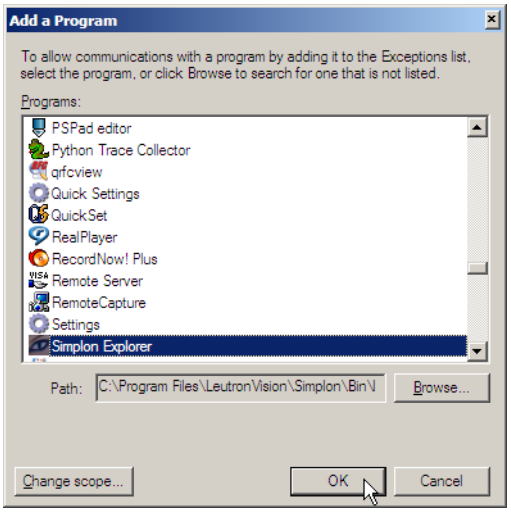
1. Connect the camera to proper 10—26V power supply.

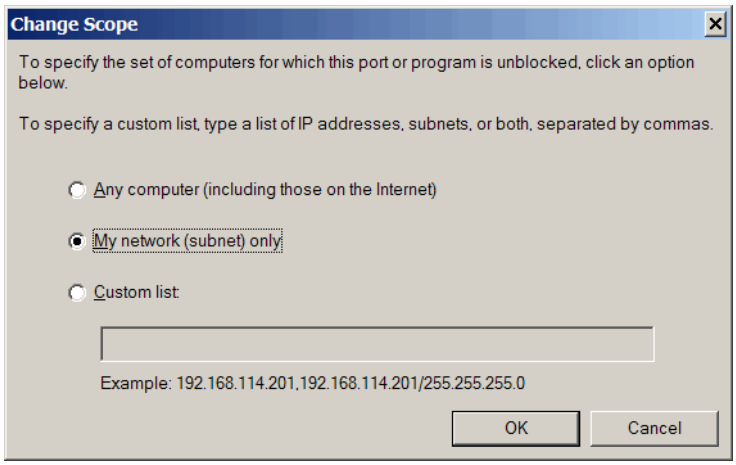
2. Connect the camera to the network, or directly to the PC using a suitable Ethernet cable. We recommend to use shielded (S/STP) category 6 cable or better.

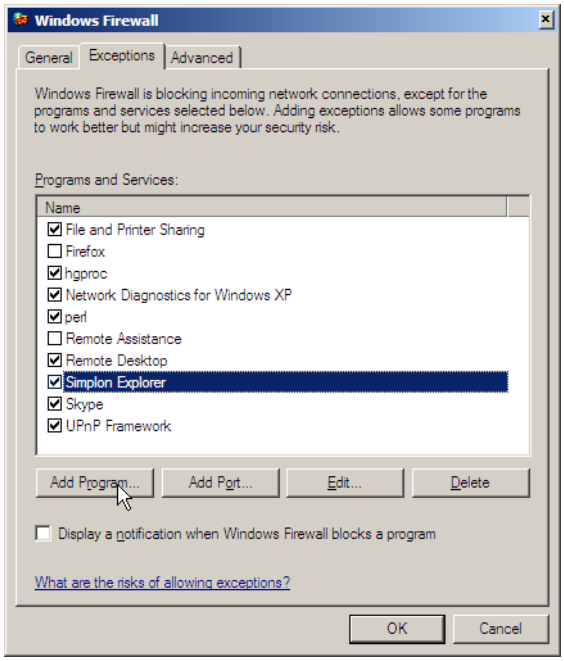
3. In optimal case, the network card interfacing the camera will be dedicated to the image acquisition only and thus will have no access to internet. In such case the firewall can be fully disabled for this network interface. In Windows Firewall (configured in Control Panel) this can be selected in the Advanced configuration


Windows Firewall
General
Exceptions
Advanced
Network Connection Settings
Windows Firewall is enabled for the connections selected below. To add exceptions for an individual connection, select it, and then click Settings:
Local Area Connection
Local Area Connection 2
Settings...
Security Logging
You can create a log file for troubleshooting purposes.
Settings...
ICMP
With Internet Control Message Protocol (ICMP), the computers on a network can share error and status information.
Settings...
Default Settings
To restore all Windows Firewall settings to a default state, click Restore Defaults.
Restore Defaults
OK
Cancel

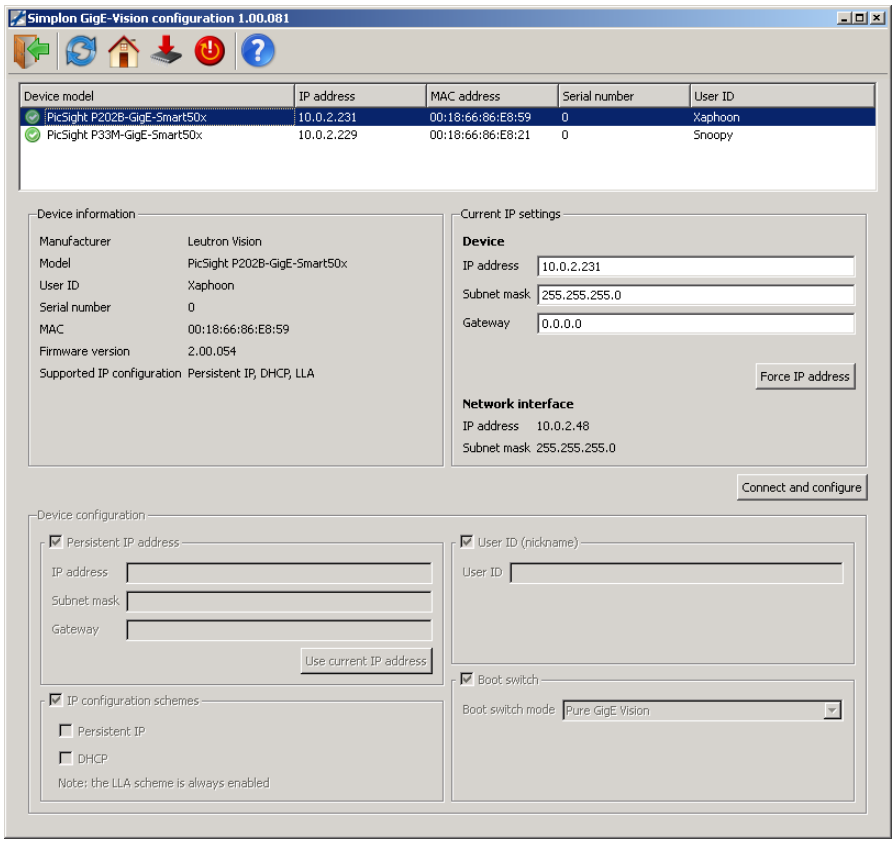
4. If your network configuration, however, requires to share internet and other network access with the image acquisition over the same media (which is not recommended practice), you will need to configure your firewall so that an it does not block the communication with the camera. In Windows Firewall this can be done by creating an exception for each application that will be accessing the camera — especially for the Simplon Explorer that we will use for the first tests (possibly limiting the exception's scope to the local subnet only). Note that the applications to be unblocked (including Simplon Explorer) are not usually present yet in the system at the time of installation, therefore this step might have to be repeated after the installation itself and again for each new application. Therefore we again recommend to have a network connection dedicated solely for camera connection — and disabling firewall fully for this connection.




Change Scope
To specify the set of computers for which this port or program is unblocked, click an option below.
To specify a custom list, type a list of IP addresses, subnets, or both, separated by commas.
Any computer (including those on the Internet)
My network (subnet) only
Custom list:
Example: 192.168.114.201,192.168.114.201/255.255.255.0
OK
Cancel




5. Verify, if the IP configuration of the connected cameras is matches your network settings. Start the Simplon GigE Vision Configuration Tool: Start → Programs → Leutron Vision Simplon → Simplon GigE Vision Configuration Tool (under Linux, start `/opt/simplon/bin/lv.ipconf`). The tool will scan for the GigE Vision cameras connected to the system. If the camera(s) is directly accessible from your PC, they will be displayed with a green “OK” icon . In such case the camera(s) is ready for acquisition, no further actions are necessary.




If the camera is displayed using a yellow icon , it is “visible” from your PC, but cannot be directly accessed, because it is configured with different subnet than your network card. In such case, select the camera in the list, adjust its IP configuration so that it matches settings of your network card, select the Fix IP checkbox and click the Set persistent Conf button. When finished, the camera's IP configuration should match the network card. It will display with the green icon in the list and will be now directly accessible from the PC. It is ready for test.

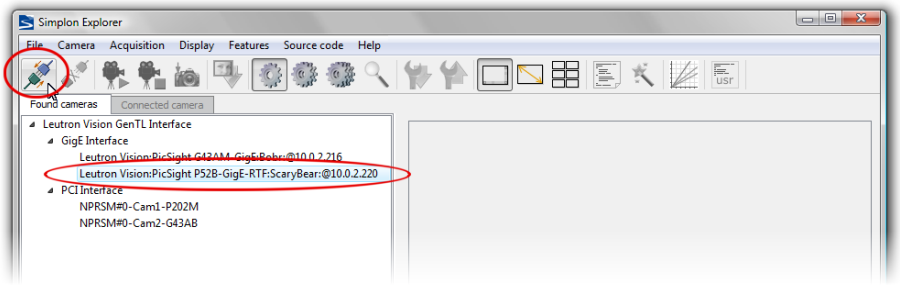
If desired, the camera's “nickname” (user name) can be adjusted as well, together with the IP configuration. The nickname can be used to identify individual cameras connected to the network.

# 1.3. Testing the camera(s)

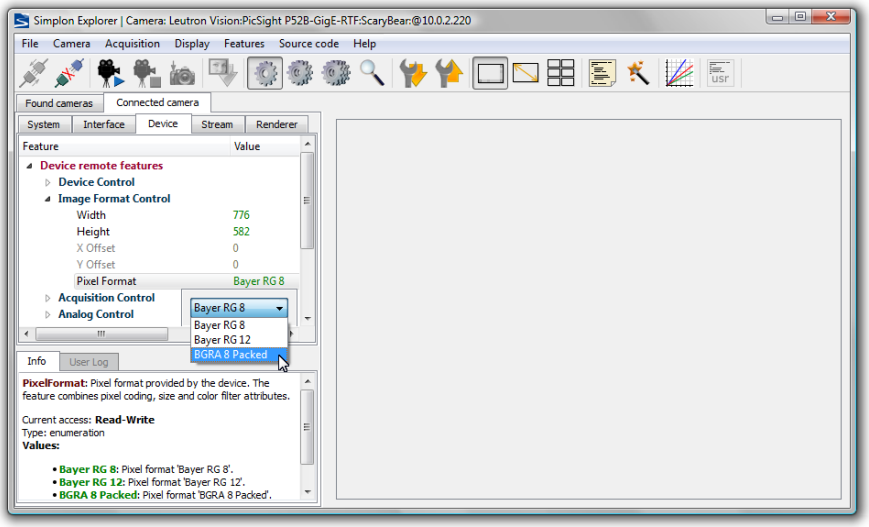
The Simplon package contains the Simplon Explorer tool, which allows to enumerate, connect and configure camera(s), acquire images or generate sample source code for Simplon API. It is a useful tool for testing both the Simplon and camera functionality.

1. Start the tool from system menu: Start → Programs → Leutron Vision Simplon → Simplon Explorer (under Linux, start `/opt/simplon/bin/lv.explorer`).

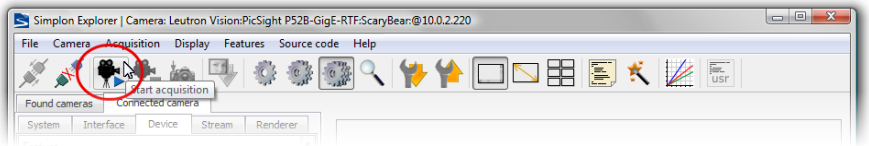
2. Connect the camera to be tested — select it in the list of found cameras and press the *Connect camera* button. Of course, the camera must be connected and powered.



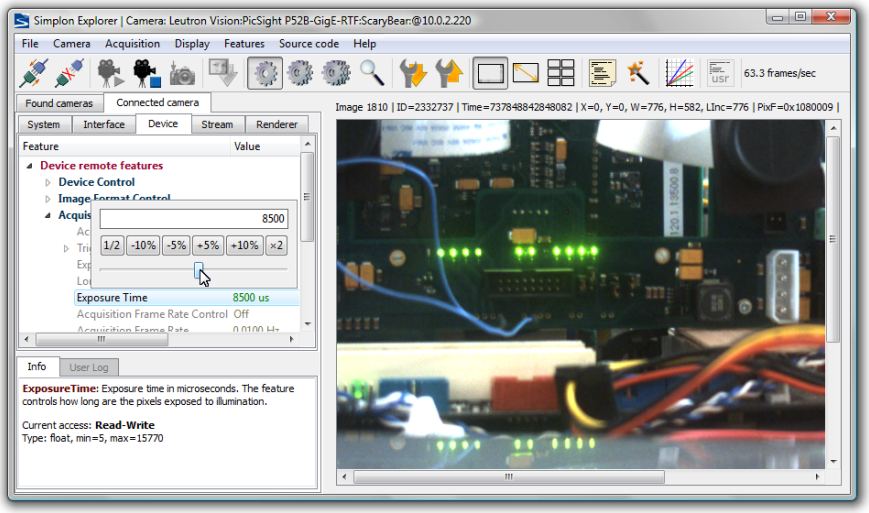

3. Configure the camera features as desired. Pay attention especially to features in `Image Format Control` and `Acquisition Control` categories.



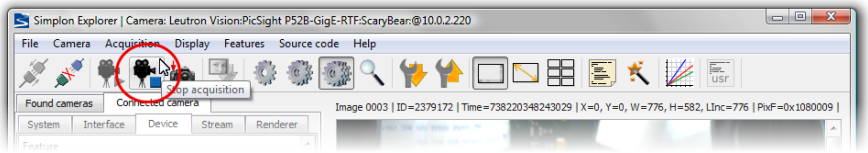

4. When prepared, click the Start acquisition button — the camera should start acquiring. If not, verify again, if the camera is properly connected and running, if the system was properly configured (remember the notes above about firewall, network configuration, etc.) or if the camera was not set to triggered mode, while no trigger was attached.




5. While the acquisition is active, you can still adjust the runtime parameters, such as exposure time or gain. Basic acquisition parameters, such as pixel format or trigger mode become locked when the acquisition starts.


Simplon Explorer | Camera: Leutron Vision:PicSight P52B-GigE-RTF:ScaryBear:@10.0.2.220
File Camera Acquisition Display Features Source code Help
63.3 frames/sec
Found cameras
Connected camera
System Interface Device Stream Renderer
Feature Value
Device remote features
Device Control
Exposure Time 8500 us
Acquisition Frame Rate Control Off
Info User Log
ExposureTime: Exposure time in microseconds. The feature controls how long are the pixels exposed to illumination.
Current access: Read-Write
Type: float, min=5, max=15770

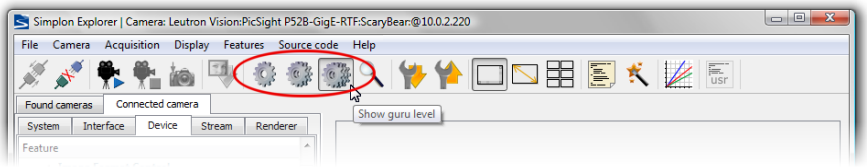
6. When finished, click the Stop acquisition button and exit.


Simplon Explorer | Camera: Leutron Vision:PicSight P52B-GigE-RTF:ScaryBear:@10.0.2.220
File Camera Acquisition Display Features Source code Help
Stop acquisition
Found cameras
Connected camera
System Interface Device Stream Renderer

# 1.4. Basic camera features

In this section we'll briefly discuss the most essential camera features important for the basic tests. Full description of all camera features is provided in Chapter 6, *Camera features and their control* [p. 96].

The Simplon Explorer displays by default only the “basic” camera features intended to handle the most common tasks. To display also the more advanced features, you need to switch to the “expert” feature level. Note that the third available level, “guru”, is intended just for debugging and should not be used for normal operation.


Simplon Explorer | Camera: Leutron Vision:PicSight P52B-GigE-RTF:ScaryBear:@10.0.2.220
File Camera Acquisition Display Features Source code Help
Found cameras
Connected camera
System Interface Device Stream Renderer
Show guru level

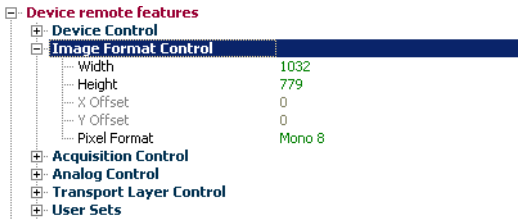
- **Image format.** The basic properties of the acquired image can be configured through features in the *Image Format* category:

  Pixel format — The *Pixel Format* feature is an enumeration allowing to specify the type of image data delivered to the application buffer. The available pixel formats differ among camera models. In general, they can be
  - Monochrome, with various number of bits per pixel, eg. *Mono 8* or *Mono 12*.
  - Bayer encoded, with sensor-dependent Bayer formats, eg. *Bayer GR 8* or *Bayer BG 8*. In this case the application needs to decode the Bayer encoded image buffer to get a proper color image — Simplon API provides functions for this.

- RGB color format, providing true RGB output, in this case the Bayer decoding is performed directly by the camera.

Image size

The camera will acquire full size image by default. The acquired image size can be reduced using the *Width* and *Height* features, which set the acquired image size in pixels. The field of view will be automatically centered within the full sensor image.




- **Acquisition parameters.** The luminance of the acquired image can be controlled either explicitly through exposure time and gain functions, or automatically through corresponding auto-functions.

Exposure time

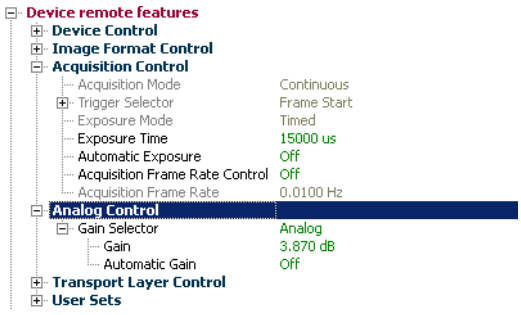
The *Exposure Time* feature in *Acquisition Control* category configures the length of the exposure in microseconds.

Analog gain

Analog gain to be applied on the sensor during acquired image digitization can be configured through corresponding features in *Analog Control* category. Verify that the *Gain Selector* feature is set to *Analog* (some cameras models support also digital gain). Now the *Gain* feature controls the desired analog gain value in decibell.

Auto-functions

Selected camera models support automatic gain and/or automatic exposure functions, when the camera keeps adjusting given parameter automatically, to maintain constant image luminance. The features will be displayed in the feature tree only if the camera supports them. To switch the auto-function on, navigate to corresponding control feature, *Automatic Exposure* in *Acquisition Control* category or *Automatic Gain* in *Analog Control* category and switch them from *Off* to *Continuous*.




- **Triggered acquisition.** The camera starts by default in “free running” mode — acquiring continuous stream of image frames. On the other hand in the triggered mode, the acquisition of individual frames can be explicitly controlled by hardware or software triggers. The trigger related features are located in the *Acquisition Control* category.

Triggered mode

To switch the camera to triggered mode, open the *Trigger Selector* subtree and set *Trigger Mode* to *On*. After starting the acquisition again, the camera will acquire images only when explicit trigger signal arrives.

Trigger source

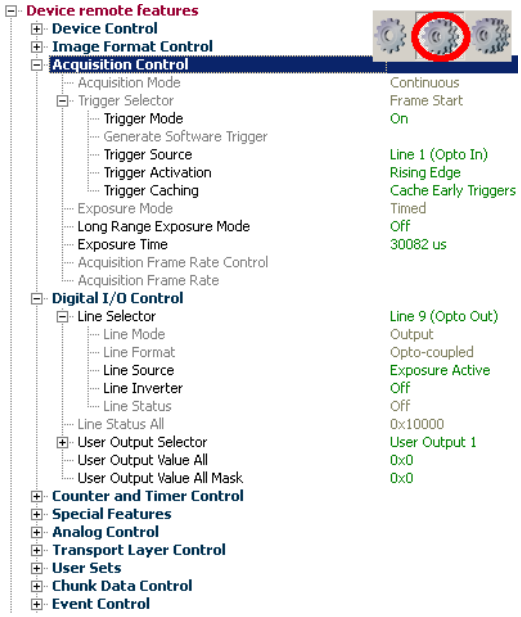
The *Trigger Source* enumeration allows to select where should the camera "listen for triggers. You can select either *Software* or one of the camera's I/O lines. The assignment of the I/O lines to the connector pins is described in Section 3.8, "Connector and cable description" [p. 44]."

Software triggering

The software triggers can be issued during active acquisition in triggered mode, regardless whether the trigger source is set to *Software* or a physical I/O line. To apply the software trigger, select the *Generate Software Trigger* feature and click the button which pops up.

Strobe

The strobe can be configured using features in the *Digital I/O Control* category, after switching the feature visibility level to "expert". Select the desired output line, where the strobe pulses should be applied through *Line Selector* (the I/O line mapping to interface connector pins is described in Section 3.8, "Connector and cable description" [p. 44]). Switch the strobe on for the selected line by setting *Line Source* to *Exposure Active*. The camera will issue a strobe pulse aligned with the exposure for every acquired frame. The strobe output is available only in triggered mode.




- **Information about the camera.** It is frequently necessary to query the basic information about the camera. The information is available through features in the *Device Control* category.

  Device identity

  The most important features identifying the camera are *Vendor Name* and *Model Name*. The camera's serial number is stored as string in feature *Device ID* (available only in "expert" feature level). Finally, the "nickname" used to identify the device is accessible (read/write) in *Device User ID*.

  Firmware version

  The version of the firmware loaded on the camera is accessible as string in feature *Device Firmware Version*.

  IP configuration

  The information related to device's IP configuration, such as *Current IP Address*, *Current Subnet Mask*, *MAC Address* and other related features are located in the *Transport Layer Control* category.

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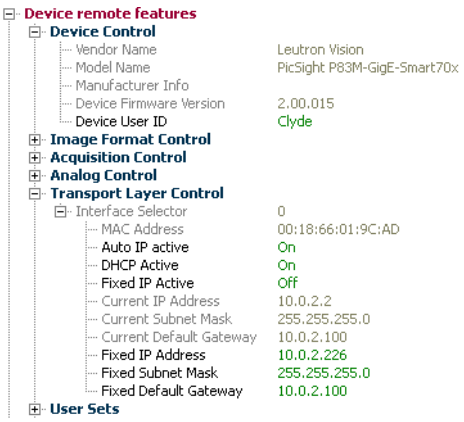
Device remote features
Device Control
Vendor Name
Leutron Vision
Model Name
PicSight P83M-GigE-Smart70x
Manufacturer Info
Device Firmware Version
2.00.015
Device User ID
Clyde
Image Format Control
Acquisition Control
Analog Control
Transport Layer Control
Interface Selector
0
MAC Address
00:18:66:01:9C:AD
Auto IP active
On
DHCP Active
On
Fixed IP Active
Off
Current IP Address
10.0.2.2
Current Subnet Mask
255.255.255.0
Current Default Gateway
10.0.2.100
Fixed IP Address
10.0.2.226
Fixed Subnet Mask
255.255.255.0
Fixed Default Gateway
10.0.2.100
User Sets

# 2. Basic information

## 2.1. Product package

The standard product package contains just the camera itself.

Any required camera accessories (Section 2.4, “Accessories” [p. 24] should be ordered separately.

Camera control software (Simplon), device drivers and other updates can be downloaded from our download area[1] free of charge.

## 2.2. PicSight model naming convention

To better understand PicSight model names, we outline below the basic rules used for naming PicSight cameras. This reference should help you understand the camera names and the available camera options. Note that this explanation is just a hint, the naming convention can be changed any time in future.

Every PicSight name has following form: **`Annnm(Rs)C(F)-I-(Ri)L-(O)`**. Meaning of individual name components is explained below:

`A` Sensor type. Possible values are:
- `P` — CCD sensor, progressive scan, interline transfer
- `G` — CMOS sensor with global shutter
- `R` — CMOS sensor with rolling shutter
- `T` — CCD sensor, progressive scan, frame transfer
- `F` — CCD sensor, progressive scan, frame readout
- `I` — CCD sensor, interlaced (2 or multiple fields)

`nnn` Total number of pixels divided by 100000 and rounded. Leading zeros are not displayed (which results in 1–3 digit number).

`m` Imager size. Possible values are:
- `0` — 1" or bigger
- `1` — 2/3" or bigger
- `2` — 1/2", 1/1.8" or bigger
- `3` — 1/3", 1/2.7" or bigger
- `4` — 1/4" or bigger
- `5` — 1/5" or bigger
- `6` — 1/6" or bigger

`Rs` Optional. Sensor revision. Allows to distinguish a new revision of the same sensor of other manufacturer or another, very similar sensor with same basic properties. The original model has the revision flag omitted. Additional revisions are flagged with `A`, `B`, etc.

`C` Color coding. Possible values are:
- `M` — monochrome
- `I` — monochrome, IR sensitive
- `B` — Bayer encoded color

`F` Optional. Optical filter. If omitted, specifies a camera with the default IR-blocking filter. Other options are:
- F — float glass filter
- D — daylight blocking filter
- N — no filter

[1] http://www.leutron.com/support-downloads/download-area/

`I` Interface. Possible values are:
- `GigE` — GigE Vision (gigabit Ethernet)
- `GigE-PoE` — GigE Vision with Power over Ethernet
- `Smart502` — smart camera (gigabit Ethernet version with on-camera processing)
- `Smart502-PoE` — smart camera with Power over Ethernet
- Other values, such as `Smart`, `Smart702` or others were used on older PicSight-GigE models not covered by this manual.

`Ri` Optional. Interface revision. Allows to distinguish a new revision (generation) of the same camera interface module. The original interface generation has the revision flag omitted. Additional revisions are flagged with `A`, `B`, etc.

`L` Connector layout. Possible values are:
- `S` — the camera interface contains the 26-pin SDR and 12-pin Hirose connectors.
- `R` — the camera interface contains the 12-pin Hirose and 6-pin Hirose connectors.

`O` Optional. Defines additional features available for a given model. For basic model version (no additional features) it is omitted. Multiple options can be specified. The possible values might be for example:
- `RTF` — real time functions (like Bayer decoder, shadow correction, etc.), available for PicSight-GigE only
- `H` — horizontal, 90° lens mount

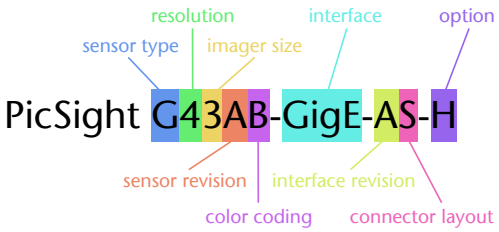


*Figure 2.1. PicSight-GigE naming convention illustrated*

## 2.3. Ordering option summary

Every PicSight-GigE basic model (see Appendix A, *Technical specifications for individual models* [p. 293]) can be further customized through additional options. Note that the following list does not contain "options" which are represented by separate article numbers in our product list (such as the right angle camera case or Power over Ethernet versions).

Following ordering options are available for high quantity OEM's:

IR-cut filter — By default, the cameras are delivered with an IR-cut filer mounted on top of the sensor. Optionally, every model can also be delivered without this filter. See more details in Section 3.6, "IR-cut (or other) filter" [p. 38]. Query us about possibility to deliver the camera with other (e.g. daylight blocking or float glass) filter.

Lens mount — The cameras can be delivered with CS-mount optical head instead of the standard C-mount version.

Other options might be available for high quantity OEM's, please contact Leutron Vision for more information.

## 2.4. Accessories

The list of PicSight-GigE accessories might grow in future, please contact Leutron Vision to learn all the options and to get the ordering/pricing information.

| | |
|---|---|
| Cables | • Cable with SDR-26-pin female connector to connect the external device control signals of PicSight-GigE to customized hardware, other side of the cable has mounted D-sub 25-pin female connector, 3m. Ordering number: 32032. |
| Connectors | • Hirose 12-pin female connector to match the male version mounted on the camera — can be ordered from www.digikey.com[2], article number HR10A-10P-12S.<br>• Hirose 6-pin female connector to match the male version mounted on the camera — can be ordered from www.digikey.com[3], article number HR10A-7P-6S.<br>• 26-pin SDR male plug with hood/solder version for PicSight-GigE external device control connector. Ordering number: 24199. |
| Power supply | • Power Supply for PicSight-GigE, 100-240 VAC input, 12VDC/1A output, Hirose 12-pin connector. Ordering number: 73513.<br>• Power Supply for PicSight-GigE with switch connected to trigger input and LED to flash output, Hirose 6-pin connector (for PicSight-GigE-AR models only). Ordering number: 73512. |
| Mounting | • Mounting plate to fix all PicSight-GigE-AR and PicSight-Smart cameras on standard tripods, including screws. Not applicable to legacy cabinet version R1 (see Section 3.2, “Dimensions” [p. 31]). Ordering number: 999011.<br>• Mounting plate to fix all PicSight-GigE-H and PicSight-Smart-H and (90° lens mount) cameras on standard tripods, including screws. Not applicable to legacy cabinet version R1 (see Section 3.2, “Dimensions” [p. 31]). Ordering number: 999021. |
| Simplon software package | CD with Simplon software suite for Windows-XP/7 and Linux, including Simplon Explorer to control PicSight and CheckSight cameras, comprehensive programming library with automatic source code generator, compatible to GenICam, GenTL and GigE Vision standards, Simplon GigE Vision Configuration Tool, firmware maintenance tool, software drivers for CheckSight and all related hardware and software documentation. Ordering number: 16060. |
| PicSight-Smart development suite | CD with C/C++ library, PSOS-operating system kernel and Cross-development environment under Windows to generate programs which run on all PicSight-Smart cameras. Ordering number: 16050. |

## 2.5. GigE Vision compatible and legacy boot modes

Since the PicSight-GigE camera family was “born” even before the GigE Vision standard was ratified, the cameras were originally using a proprietary communication protocol. Our legacy software package, LV-SDS, controlled the cameras through this protocol.

After ratification of the GigE Vision and GenICam, PicSight-GigE adopted these standards, operating in a dual mode — when being accessed by a GigE Vision application, they communicated in GigE Vision protocol, when being accessed by an LV-SDS application, they communicated over the proprietary protocol.

[2] http://www.digikey.com/
[3] http://www.digikey.com/

After introducing the new Simplon software package, which is fully GigE Vision and GenICam compatible, there is no more need for the proprietary protocol and all the newly delivered PicSight-GigE cameras are purely GigE Vision compatible only.

For compatibility with the legacy LV-SDS applications, it is, however, still possible to boot the camera in the legacy dual mode, supporting the old protocol. The configuration options for switching the working mode are discussed in Section 5.3, “HTTP-based configuration” [p. 82], Section 6.15, “Special features” [p. 196] and Section 5.5, “Firmware recovery” [p. 89].

# 2.6. Standard conformity

## 2.6.1. GigE Vision & GenICam

- The cameras implement the GigE Vision standard and were properly registered as GigE Vision compliant devices with AIA.
- The cameras (and supporting libraries) fully implement the GenICam standard, including SFNC (Standard Features Naming Convention) and GenTL.

Detailed information about these industrial standards and their use in our products is provided in Chapter 8, *Vision Standards*

## 2.6.2. CE & FCC

- The cameras fulfill EMC standards 55022:1998/A1:2000/A2:2003 (emissions) and 55024:1998/A1:2001/A2:2003 (immunity).
- The equipment complies with the requirements of a FCC part 15 Class A Digital Device, the FCC Mark is not applicable for Class A products

### 2.6.2.1. Declaration of conformity

**DECLARATION OF CONFORMITY**
*KONFORMITÄTSERKLÄRUNG*

Leutron Vision

**Equipment:** **Digital Camera**
*Geräteart:*

**Brand:** **PicSight**
*Handelsmarke:*

**Type:** **PicSight GigE**
*Typ:*

**Further Description:** **See technical data sheet**
*Weitere Angaben:* *Siehe Technisches Datenblatt*

**The signing legal authorities state that, the above-mentioned equipment meets the requirements for EMC according to:**

**DIRECTIVE OF COUNSEL 89 / 336 / EEC, Electromagnetic Compatibility EMC**

*Die Unterzeichnenden erklären als rechtsverbindliche Bevollmächtigte, dass das oben erwähnte Gerät den folgenden EMV-Anforderungen entspricht.*

*RICHTLINIE DES RATES 89 / 336 / EWG, Elektromagnetische Verträglichkeit EMV*

**The following harmonized standards have been used:**
*Folgende harmonisierte Normen wurden angewandt:*

**EN 55022: 1998 + A1:2000 + A2:2003**
**EN 55024: 1998 + A1:2001 + A2:2003**

**The equipment compiles with the requirements of:**
*Das Gerät erfüllt die Vorschriften eines:*

**FCC part 15 Class A Digital Device**

**It was verified by the Verification procedure.**
*Die Vorschriften wurden verifiziert durch die Verifikationsprozedur*

**Test report for EMC:** **Test results, diagrams**
*Prüfbericht für EMV:* *Testresultate, Diagramme*

**Test Laboratory:** **EMC-Testcenter Zurich AG, Postfach 268, CH-8052 Zürich accredited according to ISO / IEC 17025**

*Prüfstelle:* *EMC-Testcenter Zürich AG, Postfach 268, CH-8052 Zürich akkreditiert gemäss ISO / IEC 17025*

**Manufacturer Name:** **Leutron Vision AG, CH-8152 Glattbrugg**
*Hersteller:*

**Authority:** Mathias Leumann, President
*Bevollmächtigter:*

Glattbrugg 19. Mai 2006

**City** **Date** **Signature**
*Ort* *Datum* *Unterschrift*

### 2.6.2.2. Regulatory notices

The cameras should be used with properly shielded cables (and other equipment) recommended in this manual.

Please contact us if you need further information regarding the necessary equipment.

## 2.6.3. RoHS

All units delivered after June 30, 2006 are RoHS compliant.

# 2.7. Environmental requirements

- Operating temperature: 0 °C–50 °C

- Operating relative humidity: 20 %–95 %, non-condensing
- Allow sufficient air circulation around the camera to prevent heat-up

*If exposed to environment conditions outside the specified limits, camera performance can be significantly degraded or the camera can be damaged.*

## 2.8. Technical specifications overview

Since the PicSight-GigE/PicSight-Smart families contain variety of camera models, featuring different image sensors and differing in other options, lot of the technical specifications are strongly model specific. The following table provides just a brief overview of the important common properties. The model specific information is provided in Appendix A, *Technical specifications for individual models* [p. 293] and Appendix B, *Technical specifications for the "smart" models* [p. 332]. Details about individual camera components and their properties are given in corresponding chapters of the manual, in particular in Chapter 3, *Hardware interface and installation* [p. 29].

| **Specification** | **PicSight-GigE/PicSight-Smart camera family** |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensors | CCD and CMOS, VGA to 5 MPx, monochrome and Bayer encoded color |
| Video format | Up to 12-bit progressive scan |
| Trigger modes | Normal (free running), triggered, long range exposure |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Standards | GigE Vision, GenICam, GenTL, CE, FCC, RoHS |
| Software | • Full featured SDK (Simplon API)<br>• Compatible with GigE Vision based software packages<br>• Compatible with GenICam GenTL based software packages |
| Firmware | Field upgradeable |
| Configuration | • GenICam/GigE Vision interface<br>• Simplon GigE Vision Configuration Tool<br>• HTTP interface |

*Table 2.1. PicSight-GigE/PicSight-Smart family, common technical specifications*

# 3. Hardware interface and installation

## 3.1. Appearance overview

*Figure 3.1. PicSight-GigE camera, front-left view*

*Figure 3.2. PicSight-GigE camera, back-view view, PicSight-GigE-AR and PicSight-GigE-AS models*

*Figure 3.3. PicSight-GigE camera, standard and “right angle” case*

*Figure 3.4. PicSight-GigE camera with attached zoom lens*

### 3.1.1. Camera case revision R1

Following figure illustrates the older camera case revision R1. The differences are detailed in Section 3.2, “Dimensions” [p. 31].

*Figure 3.5. PicSight-GigE camera, case revision R1*

## 3.2. Dimensions

The following figures show mechanical dimensions of the PicSight-GigE cameras, location of the connectors, location and size of the mounting screws. The cameras are available in the “standard” and “right-angle” case.

Furthermore, the cameras exist in the PicSight-GigE-AS (newly delivered cameras) and PicSight-GigE-AR (legacy variant) modifications. The two mechanically differ only in the back panel, so the other views are not repeated for both variants again.

The camera case version documented on following drawings might be referred to as “case revision 3 (R3)” in other documents. All newly delivered cameras are packaged in this case. Older deliveries included case revision R1, described below.

### 3.2.1. Standard camera case

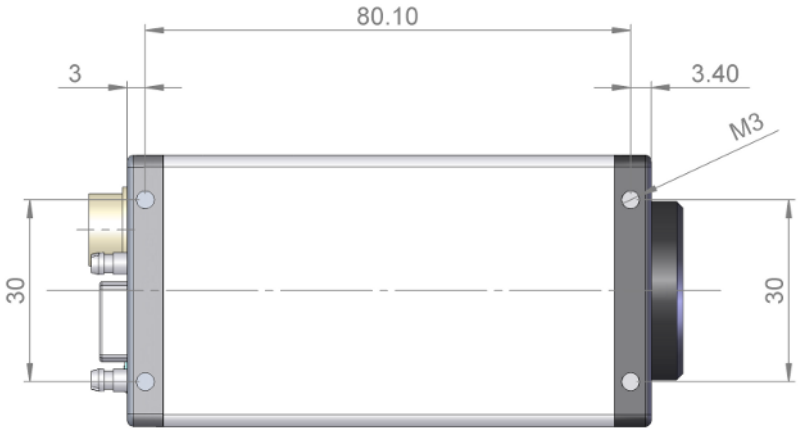


*Figure 3.6. PicSight-GigE-AS dimensions, bottom view*

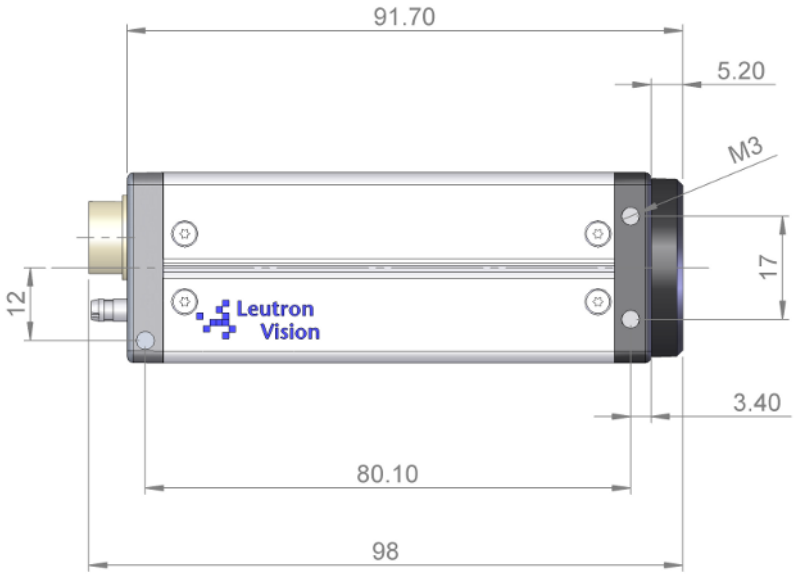


*Figure 3.7. PicSight-GigE-AS dimensions, side view*

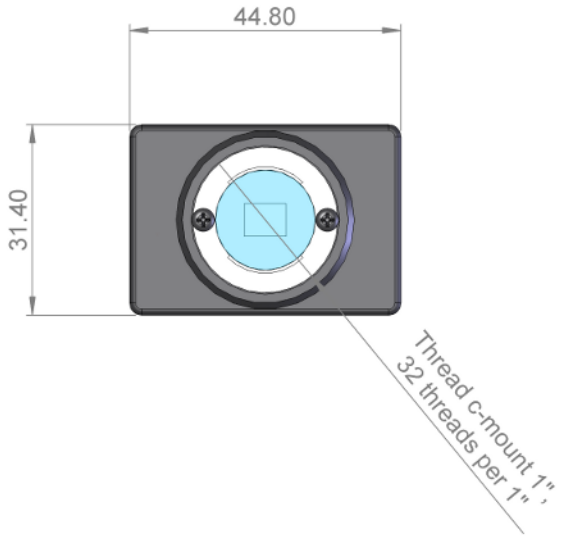


*Figure 3.8. PicSight-GigE-AS dimensions, front view*

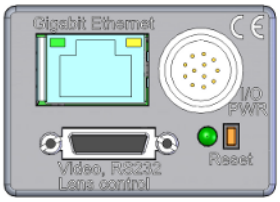


*Figure 3.9. PicSight-GigE-AS dimensions, back view*

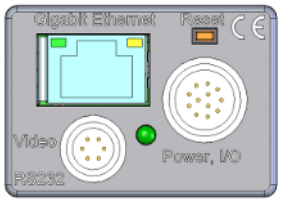


*Figure 3.10. PicSight-GigE-AR (the legacy variant) dimensions, back view*

### 3.2.2. Right-angle camera case

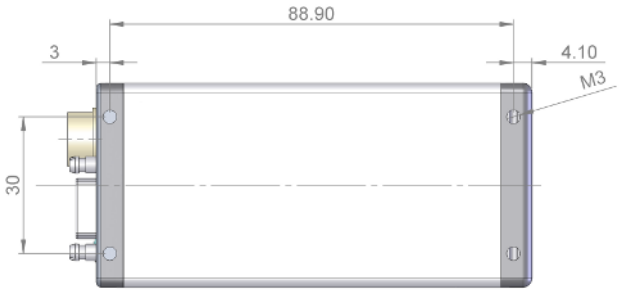


*Figure 3.11. PicSight-GigE-AS-H dimensions, bottom view*

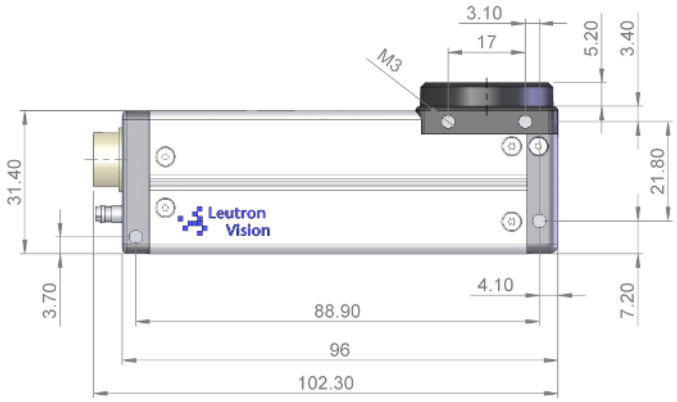


*Figure 3.12. PicSight-GigE-AS-H dimensions, side view*

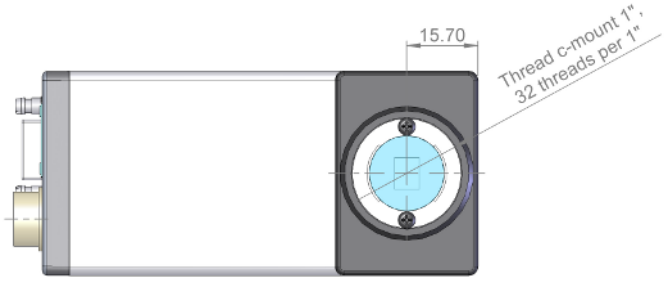


*Figure 3.13. PicSight-GigE-AS-H dimensions, top view*

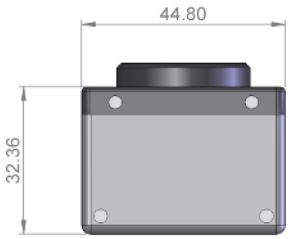


*Figure 3.14. PicSight-GigE-AS-H dimensions, front view*

*Figure 3.15. PicSight-GigE-AS-H dimensions, back view*

*Figure 3.16. PicSight-GigE-AR-H (the legacy variant) dimensions, back view*

## 3.2.3. Older camera case versions (R1)

The camera case revision R1 was the original case version used for PicSight-GigE. All newly delivered cameras are using the new case revision R3 described above.

The two revisions differ slightly in camera length, the other two dimensions are equal. The R1 revision is using thinner backplate and offers less mounting points. It also does not allow adjusting the flange back distance.

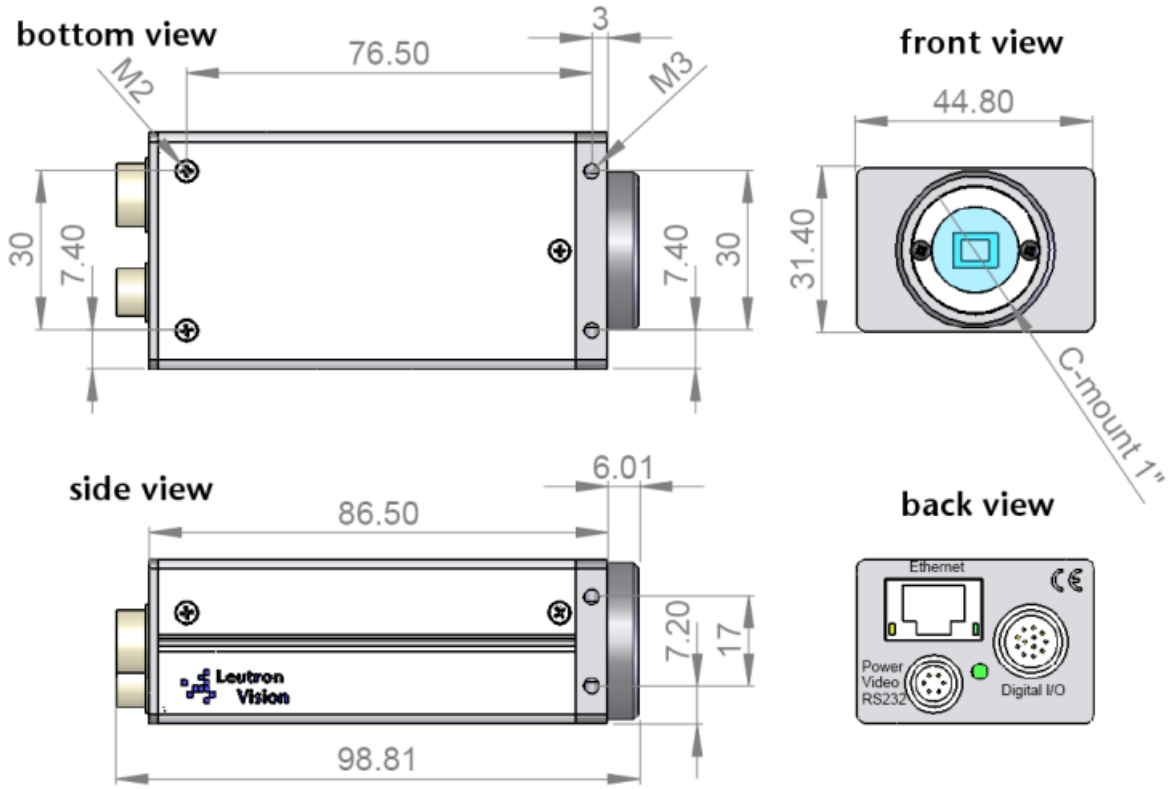


*Figure 3.17. PicSight-GigE dimensions, case revision R1, standard*

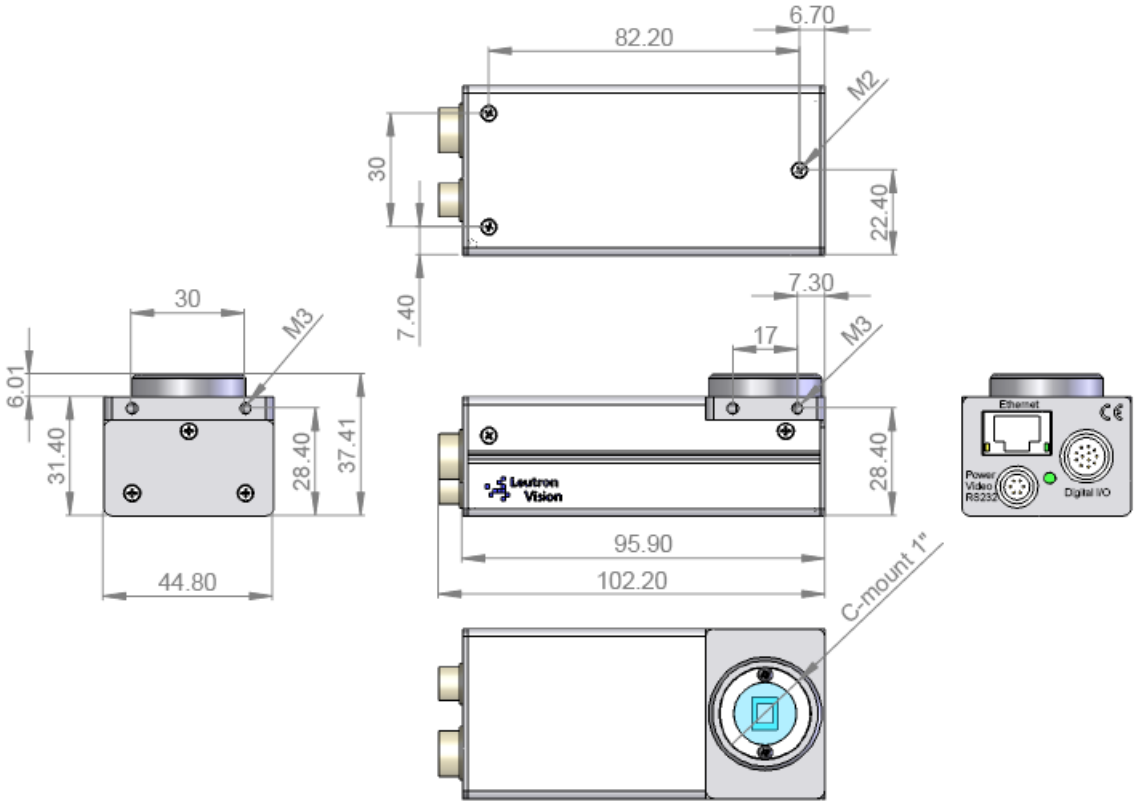


*Figure 3.18. PicSight-GigE dimensions, case revision R1, 90° lens mount*

# 3.3. Mounting points

The camera provides 8 standard mounting points on the camera head sides, two on each side (top, bottom, left, right), see Section 3.2, “Dimensions” [p. 31]. Use M3 screws going no deeper than 4 mm to the camera body for fixing the camera.

Additional 4 mounting points are available in camera's back plate, two in bottom side, one on each side, see Section 3.2, “Dimensions” [p. 31]. The holes are M3/4mm, same as the mounting points in camera head.

*The number and position of the mounting points differs on the right-angle version of camera case. See photos and drawings in Section 3.2, “Dimensions” [p. 31] and Section 3.1, “Appearance overview” [p. 29].*

## 3.3.1. Mounting points on case revision R1

The case revision R1 (see Section 3.2, “Dimensions” [p. 31]) provided lower number of mounting points.

The camera provides 8 standard mounting points on the camera head sides, two on each side (top, bottom, left, right). Use M3 screws going no deeper than 4 mm to the camera body for fixing the camera.

If these mounting points are not enough, you can additionally dismount the two M2 screws (use TORX screwdriver number 6) on the bottom part of camera's case and replace them with your own screws for fixing the camera. The screws should not go deeper than 4 mm into the camera body. If the screws go deeper than 4 mm into the camera body, you can destroy the camera.

# 3.4. Lens mount, optical head

All the models are equipped with a C-mount optical head (1–inch thread diameter, 32 threads per inch, 17.526 mm flange back). CS-mount version (identical, only with 12.5 mm flange back) is available on request for high volume OEM customers.

Few different camera head versions are used for the individual cameras to compensate for different shape (thickness) of individual sensor modules. This guarantees proper flange back 17.526 mm (distance between lens flange and the focal plane, i.e. sensor surface) as specified for C-mount. This has to be taken in account by OEMs (re)assembling the cameras. The different camera head versions are marked using little holes on side to prevent confusion. Contact Leutron Vision for more details.

## 3.4.1. Flange back distance correction

The flange back distance of the lens mount is precisely adjusted in factory for the C or CS-mount standard. There are, however, lens types which do not exactly follow the standard and require slightly different flange back distance. The PicSight-GigE cameras (since case revision R3) allow to adjust the lens mount to match such lens types.

The lens mount thread can be released using two 1mm hex-socket screws accessible from the mount point holes in one of the sides of the camera's head. When viewing the camera from the front side, the screws are in the mounting points at the right side. After loosening them, the lens mount thread is released and the flange back distance can be adjusted. When finished, fasten the screws again.

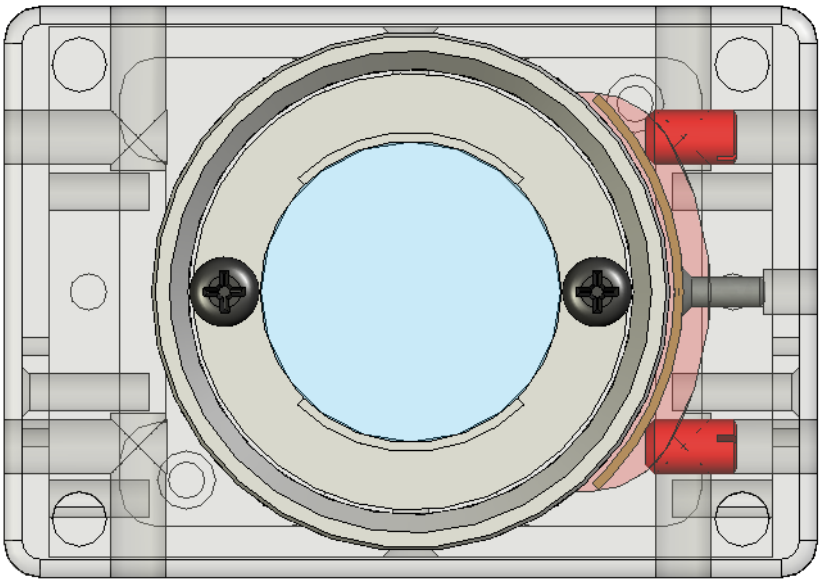

*Figure 3.19. Screws (red) fixing/releasing the lens mount thread*

*Once the flange back distance is user-modified, the factory precision is lost. Therefore this procedure is strongly discouraged, unless required due to a non-standard lens type use.*

*The flange back distance adjustment is not possible on PicSight-GigE cameras delivered with the older case revision R1 (see Section 3.2, “Dimensions” [p. 31]).*

# 3.5. Sensor

## 3.5.1. Sensor types

### 3.5.1.1. Progressive scanning

All Leutron Vision cameras provide progressive scan video output. The camera outputs full frame data in sequential order (no field interlacing).

### 3.5.1.2. CMOS vs. CCD

Leutron Vision series offers models with both CMOS and CCD sensors worlds, providing advantages of both technologies.

While CCD chips have reputation of great image quality and high sensitivity, CMOS imagers usually offer higher resolution and dynamic range. But the decision should always be made camera by camera, application by application. The camera series provides wide choice of CCD and CMOS sensors to cover wide range of applications.

### 3.5.1.3. CMOS: global vs. rolling shutter

Some of the cameras with large CMOS sensors are equipped with a rolling shutter. In contrary to the global shutter, where all camera pixels are exposed at exactly the same time, with rolling shutter the exposure of every single line is slightly time-shifted relative to the previous line. This requires some special considerations, especially when capturing moving objects. Flash illumination is desirable.

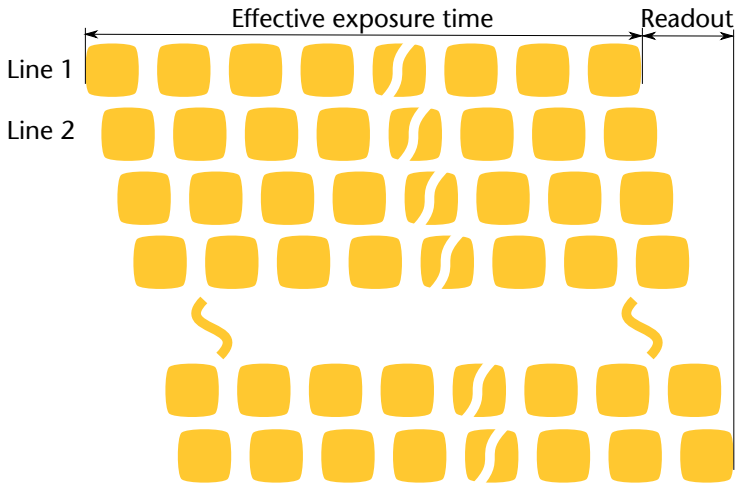


*Figure 3.20. Rolling shutter*

### 3.5.1.4. CCD readout types

Most of the CCD sensors are designed with interline transfer readout. These sensors have photosensitive pixels organized in columns with light-shielded registers in between them. Upon exposure end the charge from the photosensitive cells is quickly transferred to these storage registers. It is then read out from these registers sequentially, line by line, pixel by pixel and sent to the camera output.

One of the cameras is an exception from this rule, possessing a sensor with frame transfer readout. Such chip is divided into two distinct regions, one photosensitive, the other light-shielded. Upon the exposure end the charge is quickly transferred from the photosensitive area to the storage part of the sensor. Then the image is sent sequentially to the output as usual.

## 3.6. IR-cut (or other) filter

All the cameras have by default an IR-cut filter mounted on top of the sensor. User has however an option to choose from different configurations:

- IR-cut filter mounted on top of the sensor (default). CCD based cameras come with a 720nm filter, CMOS based ones with 640nm filter.
- Clear glass filter (of the same size as the original IR-cut filter) mounted on top of the sensor. Check, whether you don't need special lens designed for specifically for use without IR-cut filter (common lens might not focus properly in the infrared band or show other problems).
- Daylight blocking filter.
- Without any sensor cover mounted. This has impact on optical properties of the camera — the C-mount flange distance from the sensor is accurately adjusted for the use of the IR-cut filter and removing the filter decreases the length of the optical path. With some lenses and working area setups it can become impossible to focus properly.

*User should understand what impact such options can have on the image quality and lens choice and choose option best suiting given application.*

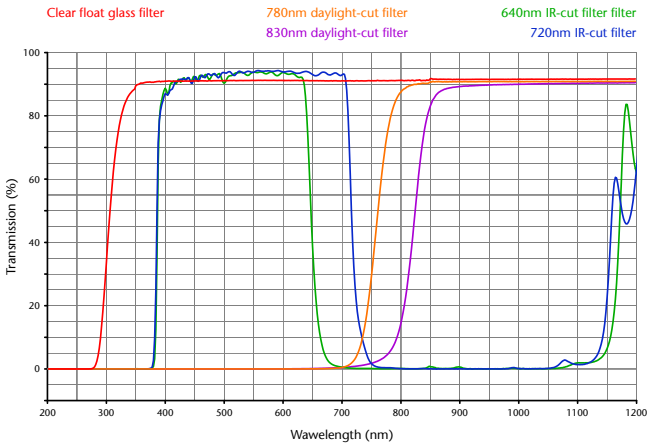


*Figure 3.21. Spectral characteristics of individual filter types*

### 3.6.1. Changing or removing the filter

The filter is accessible from outside the camera and user can change it without loose of warranty. It is very important to do this operation with maximum care so that the image sensor cannot be damaged.

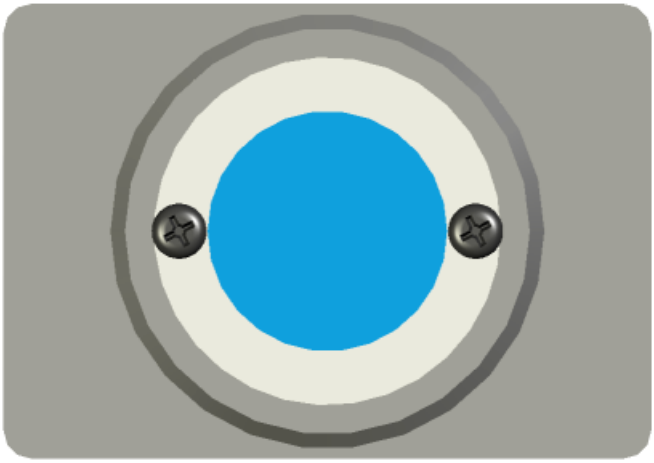

*Figure 3.22. IR-cut filter fixing screws*

If exchanging the filter for another type, it is highly recommended to choose a filter of the same size, not to change the optical properties of the system. Removing the filter completely will change the length of the optical path which can lead to focusing problems in some scenarios.

To mount/dismount the filter, you will need a TORX screwdriver number 6 (note that some of the first units used hexagonal screws instead). The fixing screws are M2×3.

*It's important to keep in mind that when changing or removing the filter, not only can be the sensor damaged, but also dust or other dirt can get inside the camera and especially on top of the sensor itself. It is necessary to perform such operation in appropriately clean environment and using suitable tools preventing any sensor dust pollution.*

## 3.7. Input and output signals

This section describes all types of input and output signals available on PicSight-GigE cameras, including their characteristics and when necessary including connection examples. Location and

pinouts of the connectors carrying the signals is documented in Section 3.2, “Dimensions” [p. 31] and Section 3.8, “Connector and cable description” [p. 44].

## 3.7.1. DC power input

The cameras accept 10–26 V DC power input.

The power consumption varies among individual models.

The power input can be connected to one of the camera's interface connectors (see Section 3.8, “Connector and cable description” [p. 44]). The power input pins available on the individual connectors are internally connected in the camera.

### 3.7.1.1. Power over Ethernet (PoE)

The PicSight-GigE/PicSight-Smart cameras can be delivered with the Power over Ethernet option. The “PoE” cameras are compatible with the Power over Ethernet standard, version IEEE 802.3af. They should be used with PoE switches (“endspans”) or power injectors (“midspans”) complying with the IEEE 802.3af specification.

Both PoE modes (A and B) are supported by the camera. Beware of using the PoE cameras with 100Mbit Ethernet only cables, where the “spare” wire pairs might be omitted. With such cable, the power wouldn't be delivered when using Mode B compatible power sourcing equipment.

The PicSight-GigE PoE camera models are classified in the power level class 0. The power consumption of a PoE model is slightly higher than consumption of the same “regular” model. When connecting multiple PoE cameras to a single PoE switch, verify, how much total power the switch can provide and how it handles cases when the limit is exceeded.

The PoE cameras are powered solely over the Ethernet cable, the power input pins on other camera interface connectors (see Section 3.8, “Connector and cable description” [p. 44]) are disconnected.

## 3.7.2. Ethernet connection

The camera uses Gigabit Ethernet interface. It is fully compatible with the 1000BASE-T standard (also known as IEEE 802.3ab) — Gigabit Ethernet over copper. It can be used in Fast Ethernet networks (100BASE-TX) if the performance of the 100Mbit network fulfills the application requirements, considering especially the limited possible frame rate.

The camera is compatible with all standard Gigabit Ethernet equipment. Recommendations regarding choice of the network cards, switches or other equipment, might be listed in Section 5.2, “Network performance” [p. 72] and Section 5.1, “Network configuration” [p. 65].

## 3.7.3. Video output

PicSight-GigE cameras output pixel data by means of standard Gigabit Ethernet interface, using a protocol compatible with the GigE Vision standard.

## 3.7.4. Trigger input

Any of the available optocoupler inputs or TTL inputs can be used for triggering. The input line mapping on the camera connectors is described in Section 3.8, “Connector and cable description” [p. 44].

The characteristics and default behavior of these interfaces are described below in Section 3.7.5, “Optocoupler interface” [p. 41] and Section 3.7.6, “TTL I/O's” [p. 43]. Those sections also provide examples how to connect the inputs.

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## 3.7.5. Optocoupler interface

Optically isolated inputs and outputs.

### 3.7.5.1. Optocoupler basics

An optocoupler is a device using optical path to transfer an electronic signal between two circuits. It basically consists of a photodiode converting the input signal to light and a phototransistor converting the light again to electronic signal.

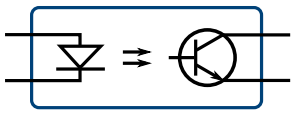

*Figure 3.23. Diagram of basic optocoupler function*

The optocoupler is useful in situations where one part of the circuit needs to be galvanically isolated from the other part to prevent damage or unwanted interference. It is used to prevent ground loops or to block voltage spikes.

For effective use of the optocoupler it is important to control it using an independent power supply. When the external circuit is galvanically connected to the camera (eg. when reusing the camera's power to control the optocoupler), the optocoupler's protective function is eliminated.

### 3.7.5.2. Optocoupler inputs

The PicSight-GigE camera is equipped with two optically isolated input lines, connected with one common pole (Section 3.8.2, “Power input & digital I/O connector” [p. 45]) due to limited number of pins on the I/O connector. The input optocouplers are polarity independent, they can be connected with any polarity. When using both optocoupler inputs, the common pole has to be connected with the same polarity for both inputs.

The optocoupler input's logical state is understood as logical `0` if no current is flowing through the optocoupler diode, logical `1` if current is flowing through the diode.

The optocoupler is guaranteed to be switched on (logical `1` status) when the voltage applied to the input is within range of 5—24 V (tolerance 10%). It is guaranteed to be switched off (logical `0`) when the applied voltage is under 1.5 V. The input status is undefined between 1.5 and 4.5 V, the input voltage must not exceed the 24 V limit.

The switching speed depends on the actual setup (eg. operating voltage, input current, temperature). The delays listed in the table are setup dependent mean values, while the jitters are maximal deviations (± ) from those mean values.

| **Parameter** | **Value** |
|---|---|
| Operating voltage | 5—24 V |
| Input current | 3mA @ 5V, 8mA @ 12V, 20mA @ 24V |
| External resistor requirement | No |
| ON voltage level | > 4.5 V |
| OFF voltage level | < 1.5 V |
| Input (OFF-ON) to sensor trigger delay | 20—23 µs (jitter +13/-2 µs) |
| Input (ON-OFF) to sensor trigger delay | 49—69 µs (jitter +14/-3 µs) |

*Table 3.1. Optocoupler input parameters summary*

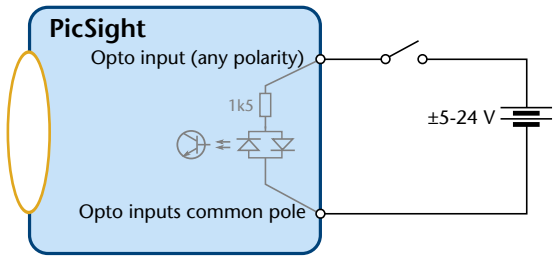


*Figure 3.24. Example of using the optocoupler inputs*

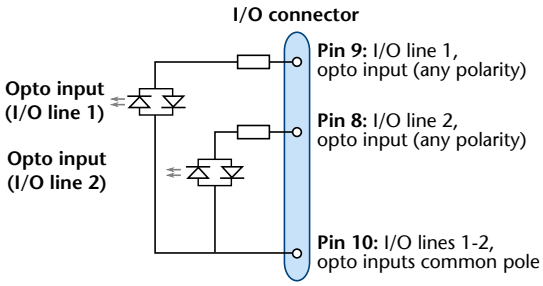


*Figure 3.25. Diagram of the internal optocoupler inputs connections*

### 3.7.5.3. Optocoupler outputs

The PicSight-GigE camera is equipped with three optically isolated output lines. The optocoupler outputs are connected with a common emitter (Section 3.8.2, “Power input & digital I/O connector” [p. 45]) due to limited number of pins on the I/O connector.

After power up, the optocoupler outputs are in high impedance state and they remain in that state until reconfigured from the software interface. Whenever the optocoupler output is disconnected in the SW interface, it gets in high impedance status.

The optocoupler output's logical state is understood as logical `0` when its output transistor is in high impedance, logical `1` if it is in low impedance mode.

The optocoupler output work with operating voltage range of 5—24 V. To take full profit of this signal isolation, you have to connect the optocoupler (tap) to an external power supply.

The maximal switched output current is 10 mA, higher current could damage the optocoupler output circuit.

The switching speed depends on the actual setup (eg. operating voltage, temperature). The delays listed in the table are setup dependent mean values, while the jitters are maximal deviations (± ) from those mean values.

| **Parameter** | **Value** |
|---|---|
| Operating voltage | 5—24 V |
| Output current | 10 mA (sink only, current flowing into the collector) |
| Output low level at 10 mA | 0.6 V |
| External resistor requirement | No |
| Opto-in (OFF-ON) to opto-out (OFF-ON) delay | 65—83 µs (jitter +11/-3 µs) |
| Opto-in (OFF-ON) to opto-out (ON-OFF) delay | 46—49 µs (jitter +10/-2 µs) |
| Opto-in (ON-OFF) to opto-out (ON-OFF) delay | 75—95 µs (jitter +11/-3 µs) |

| Parameter | Value |
|---|---|
| Opto-in (ON-OFF) to opto-out (OFF-ON) delay | 94—129 µs (jitter +12/-4 µs) |
| OFF to ON fall time (10 to 90 %) | 1.10—3.50 µs |
| ON to OFF rise time (10 to 90 %) | 40—70 µs |

*Table 3.2. Optocoupler output parameters summary*

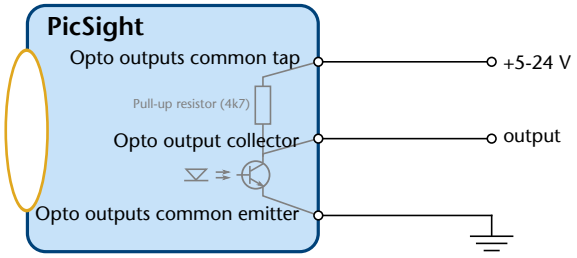


*Figure 3.26. Example of using the optocoupler outputs*

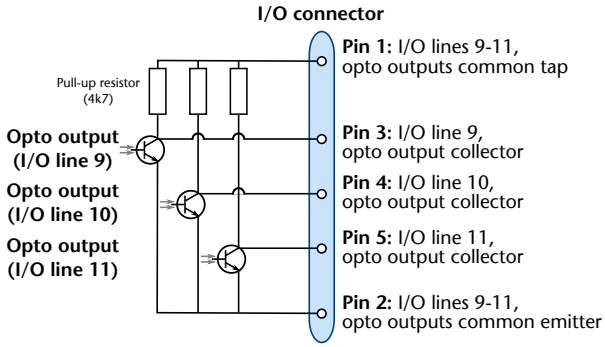
I/O connector
Pin 1: I/O lines 9-11, opto outputs common tap
Pull-up resistor (4k7)
Opto output (I/O line 9)
Pin 3: I/O line 9, opto output collector
Opto output (I/O line 10)
Pin 4: I/O line 10, opto output collector
Opto output (I/O line 11)
Pin 5: I/O line 11, opto output collector
Pin 2: I/O lines 9-11, opto outputs common emitter

*Figure 3.27. Diagram of the internal optocoupler outputs connections*

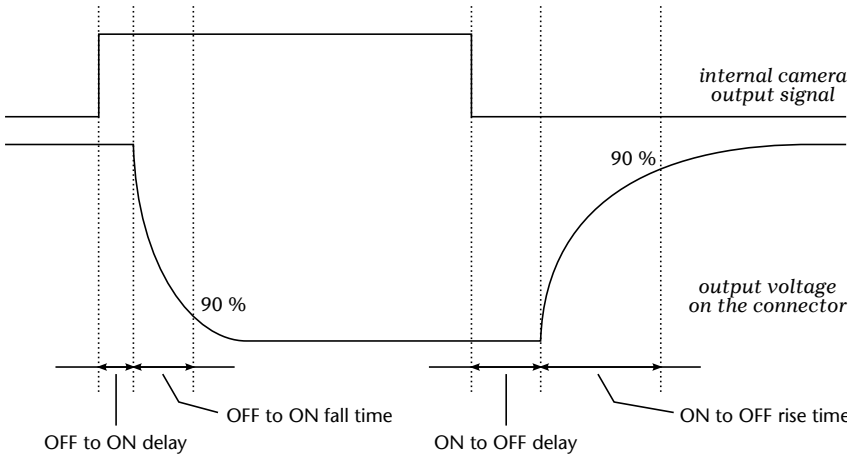


*Figure 3.28. PicSight-GigE output optocoupler timing diagram*

## 3.7.6. TTL I/O's

Standard 5V TTL (transistor-transistor logic) interface.

After power up, the TTL outputs are driven high — and they remain driven high until reconfigured from the software interface. Whenever the TTL output is disconnected in the SW interface, it gets in driven high status. TTL inputs are pulled up to 5V inside the camera to guarantee a stable input

in case nothing is connected. To generate a steep edge the TTL input driver should be capable of driving and sinking 10mA.

The TTL input's and output's logical state is understood as logical `1` when it's driven high (5V) and logical `0` when it's not driven (0V).

The delays listed in the table are setup dependent mean values, while the jitters are maximal deviations (± ) from those mean values.

| Parameter | Value |
|---|---|
| Operating voltage | 5V±10% (absolute maximum 6.5V) |
| ON voltage level | > 3.5 V |
| OFF voltage level | < 1.5 V |
| High level output current | -32mA max / high level at 3.8V min |
| Low level output current | 32mA max / low level at 0.55V max |
| Input to sensor trigger delay | 19 µs (jitter +13/-2 µs) |
| TTL-in to TTL-out delay | 32 µs (jitter +10/-2 µs) |

*Table 3.3. TTL input/output parameters summary*

### 3.7.7. Lens control interface (External ADC's & Power switches)

The lens control interface consists of three power switches able to drive most motorized zoom lens types available on the market. Three “external ADC” inputs are used as feedback — monitoring the current position of given lens function.

### 3.7.8. Serial port interface

Standard RS-232 communication interface, accessible directly from the camera's feature tree.

Configurable communication parameters are: baud rate, parity, data bits, stop bits.

## 3.8. Connector and cable description

*All the grounds from individual connectors are connected inside the camera.*

### 3.8.1. Ethernet connector

A standard Ethernet connector, 8P8C modular plug, often also referred to as RJ-45. Refer to the corresponding Ethernet specifications for more details.

The connector is equipped with two standard status LED's.

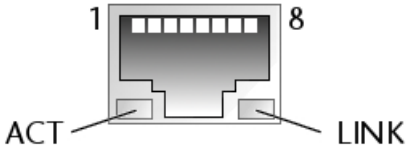


*Figure 3.29. Ethernet connector*

| Pin | Wire color code | Signal (1000BASE-T) | Signal (10BASE-T, 100BASE_TX) |
|---|---|---|---|
| 1 | white/green | BI_DA+ | TX+ |
| 2 | green | BI_DA- | TX- |
| 3 | white/orange | BI_DB+ | RX+ |
| 4 | blue | BI_DC+ | NC |
| 5 | white/blue | BI_DC- | NC |
| 6 | orange | BI_DB- | RX- |
| 7 | white/brown | BI_DD+ | NC |
| 8 | brown | BI_DD- | NC |

*Table 3.4. Ethernet connector, pinout*

*The color scheme and pinout shown in the table above applies for the straight-through cables (cable wiring standard EIA-568-A). For cross over cable, wire pairs 1–3, 2–6, 4–7 and 5–8 had to be crossed. Refer to official Ethernet connector and cabling specifications in case of any doubts.*

## 3.8.2. Power input & digital I/O connector

Hirose 12–pin male connector (HR10A-10R-12PB-71) for power input and digital I/O (TTL/opto-coupler interface).

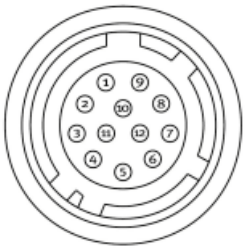


*Figure 3.30. Power input & digital I/O connector*

| Pin | Signal |
|---|---|
| 1 | I/O lines 9—11: optocoupler outputs common tap |
| 2 | I/O lines 9—11: optocoupler outputs common emitter |
| 3 | I/O line 9: optocoupler output collector |
| 4 | I/O line 10: optocoupler output collector |
| 5 | I/O line 11: optocoupler output collector |
| 6 | I/O line 25: TTL output |
| 7 | 10—26 VDC power input (disconnected on Power over Ethernet models) |
| 8 | I/O line 2: optocoupler input (any polarity) |
| 9 | I/O line 1: optocoupler input (any polarity) |
| 10 | I/O lines 1—2: optocoupler inputs common pole (any polarity) |
| 11 | I/O line 17: TTL input |
| 12 | Ground |

*Table 3.5. Power input & digital I/O connector, pinout*

## 3.8.3. External device control connector

A 26pin SDR female connector with lens control interface, serial port (RS-232) interface, power input and analog video output.

*Some of the interfaces might not be available on all camera models. In such case the corresponding pins should be left disconnected.*

*The connector is not mounted on the legacy camera versions, PicSight-GigE-AR/PicSight-Smart-R and older.*

An adapter cable with D-sub 25-pin female connector is available. The table lists also pin numbers on the D-sub connector. The cable construction is described below.

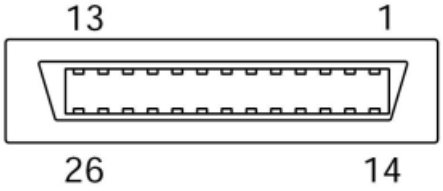


*Figure 3.31. External device control connector, pinout*

| Pin | Signal | D-sub 25 |
|---|---|---|
| 1 | Feedback voltage / External ADC ground | 12 |
| 2 | Feedback voltage input of motor 3 (Iris) / External ADC 3 (max 3.3V) | 1 |
| 3 | Feedback voltage input of motor 2 (Focus) / External ADC 2 (max 3.3V) | 2 |
| 4 | Feedback voltage input of motor 1 (Zoom) / External ADC 1 (max 3.3V) | 3 |
| 5 | Positive reference voltage for lens feedback / External ADC resistors (3.3V, output only) | 4 |
| 6 | Ground | 5 |
| 7 | Lens motor 3 - (Iris) / Power switch 3 - | 6 |
| 8 | Lens motor 3 + (Iris) / Power switch 3 + | 7 |
| 9 | Lens motor 2 - (Focus) / Power switch 2 - | 8 |
| 10 | Lens motor 2 + (Focus) / Power switch 2 + | 9 |
| 11 | Lens motor 1 - (Zoom) / Power switch 1 - | 10 |
| 12 | Lens motor 1 + (Zoom) / Power switch 1 + | 11 |
| 13 | Reserved for future use, DO NOT CONNECT! | n.c. |
| 14 | Video out CVBS | 13 |
| 15 | Reserved for future use, DO NOT CONNECT! | 14 |
| 16 | Reserved for future use, DO NOT CONNECT! | 15 |
| 17 | Video ground | 16 |
| 18 | Reserved for future use, DO NOT CONNECT! | 17 |
| 19 | Reserved for future use, DO NOT CONNECT! | 18 |
| 20 | Reserved for future use, DO NOT CONNECT! | 19 |
| 21 | 10—26 VDC power input (disconnected on Power over Ethernet models) | 20 |

| Pin | Signal | D-sub 25 |
|---|---|---|
| 22 | Reserved for future use, DO NOT CONNECT! | 21 |
| 23 | Reserved for future use, DO NOT CONNECT! | 22 |
| 24 | Reserved for future use, DO NOT CONNECT! | 23 |
| 25 | RS-232 RxD (serial data input) | 24 |
| 26 | RS-232 TxD (serial data output) | 25 |

*Table 3.6. External device control connector, pinout (including pin numbers on the SDR-26 to D-sub-25 adapter)*

### 3.8.3.1. SDR-26 connector adapter cable

An adapter cable to interface the camera's 26-pin SDR connector is available. The other side of the cable holds a D-sub 25-pin female connector. The D-sub connector can either be used directly or the cable can be opened and used to interface another custom connector type. The construction of the cable is described in the following figure.

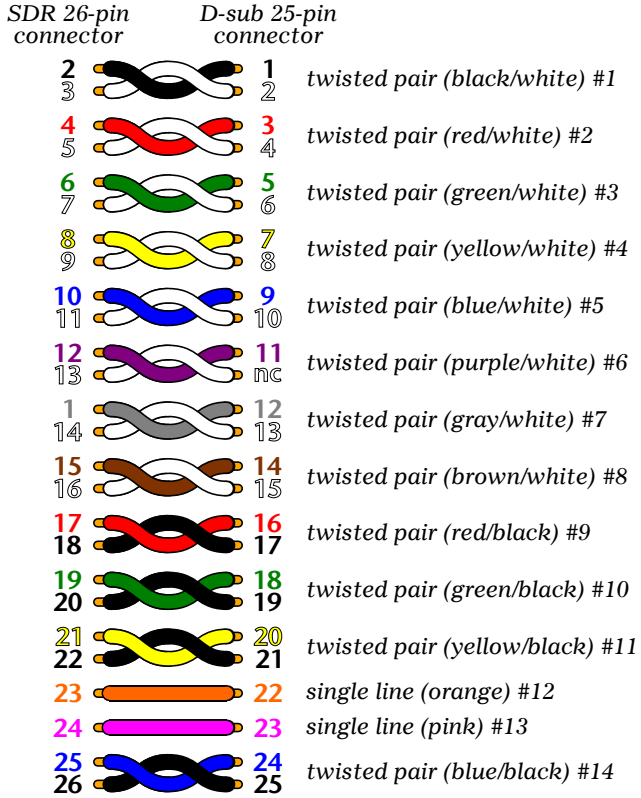


*Figure 3.32. 26-pin SDR to 25-pin D-sub adapter cable*

## 3.8.4. Legacy power input & RS-232 connector

Hirose 6–pin male connector (HR10A-7R-6PB-73) for power input and RS-232 interface.

*This connector was mounted only on legacy camera models PicSight-GigE-AR/PicSight-Smart-R. On current camera series the connector does not exist, corresponding signals are available on other connectors.*

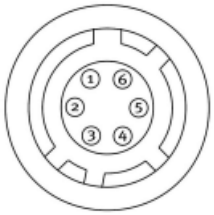


*Figure 3.33. Legacy power input & RS-232 connector*

| Pin | Signal |
|---|---|
| 1 | RS-232 TxD (serial data output) |
| 2 | RS-232 RxD (serial data input) |
| 3 | Ground |
| 4 | Reserved |
| 5 | Ground |
| 6 | 10—26 VDC power input (disconnected on Power over Ethernet models) |

*Table 3.7. Legacy power input & RS-232 connector, pinout*

# 3.9. Status LED

A status LED is placed on the back side of the camera (see Section 3.2, “Dimensions” [p. 31]). During camera boot (after powering the camera) this LED is blinking irregularly. As soon as the camera booted successfully and is ready for operation, the LED should start blinking regularly with period of approx. 2 seconds If the status LED remains blinking irregularly en error occurred during boot up. If the problem repeats in successive boots, the camera might need a firmware update or other service operation.

As soon as the camera finishes booting, the LED's on the Ethernet connector should also start shining (provided that the Ethernet cable is connected). The LED on the right side of the connector indicates a connection to a host and its color indicates the connection speed: green for 100 Mb/s, red for 1 Gb/s. The yellow LED on the left side indicates the traffic. If any of these two LED's is not shining, you should recheck the Ethernet cable connection.

# 3.10. PicSight-Smart architecture

Every PicSight-GigE camera also exists in the “smart” version (PicSight-Smart). The basic functionality and Ethernet interface of the PicSight-Smart cameras is identical to PicSight-GigE cameras, but PicSight-Smart models furthermore provide additional resources and functionality:

- 32-bit RISC processor
- additional RAM memory (64 MB or more), flash memory
- real-time operating system
- SDK including C/C++ compiler and libraries for image acquisition, camera control, communication facilities and more

This allows to perform conditioning of the acquired image or full image processing on the camera. Results of the processing can be signalled to the outside world through the i/o lines, over the serial RS-232 line or over the Ethernet interface.

The GenICam feature interface of the PicSight-Smart provides set of generic features that might be dynamically served by the smart applications and used to control it or report results. This functionality is described in Section 6.16, “Smart application control” [p. 200].

Technical details about individual PicSight-Smart cameras are listed in Appendix B, *Technical specifications for the "smart" models* [p. 332].

Complete description of the PicSight-Smart cameras and especially their programming and configuration is described in dedicated documents — contact Leutron Vision to get a copy.

# 4. Software installation

## 4.1. Simplon

Following sections provide installation instructions for Simplon on the Windows and Linux operating systems. More details regarding the installation options (other operating systems, custom installation, etc.), Simplon configuration and other related topics can be found in Simplon getting started.

*Note that the installation of Simplon is not mandatory — if you are going to use the camera from a software package compatible with the GigE Vision standard, it will connect to the camera directly. The Simplon can be, however, still useful for camera configuration, evaluation or troubleshooting.*

### 4.1.1. Installation in Windows

#### 4.1.1.1. System requirements

The Simplon for Windows does not have any particular system requirements, the installer will install all the necessary dependencies, including the .NET Framework runtime. Simplon is compatible with all "recent" Windows versions, including Windows 7, Windows Vista or Windows XP. Note that Windows versions older than Windows 2000 are not supported.

*The Simplon package installation should be performed by a user with administrator rights.*

#### 4.1.1.2. Installation media

The Simplon package can be installed from two types of installation media:

- If you obtained the installation CD-ROM, insert it to the CD-ROM drive. The installation will start automatically.
- If you don't have the installation CD-ROM or if you wish to install a newer Simplon version, you can download the installer from the download area[1] on our website. The installer file name follows pattern `Simplon`*`xyyzzz`*`.exe`, where *`xyyzzz`* stands for Simplon version.

  Execute the installer. Depending on security adjustments of your system and whether you are running the installer from a local disk or a network share, you might get following security warning. Simply proceed clicking Run.

[1] http://www.leutron.com/support-downloads/download-area/

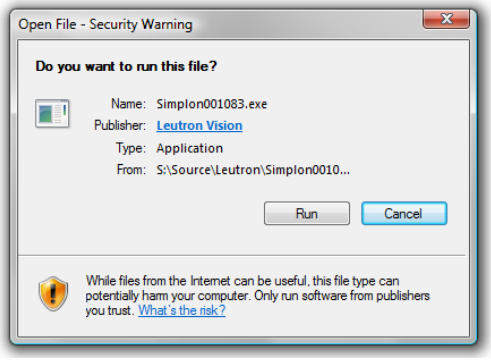
Open File - Security Warning
Do you want to run this file?
Name: Simplon001083.exe
Publisher: Leutron Vision
Type: Application
From: S:\Source\Leutron\Simplon0010...
Run
Cancel
While files from the Internet can be useful, this file type can potentially harm your computer. Only run software from publishers you trust. What's the risk?

*Figure 4.1. Simplon installation: Windows security warning*

### 4.1.1.3. Installation procedure

The paragraphs below discuss all the dialogs of Simplon's Windows installer and corresponding options. Note that some details might slightly differ between individual Simplon versions, but the principles will always be the same.

The installer first displays a welcome screen with basic information about the software you are going to install. Click Next to proceed.

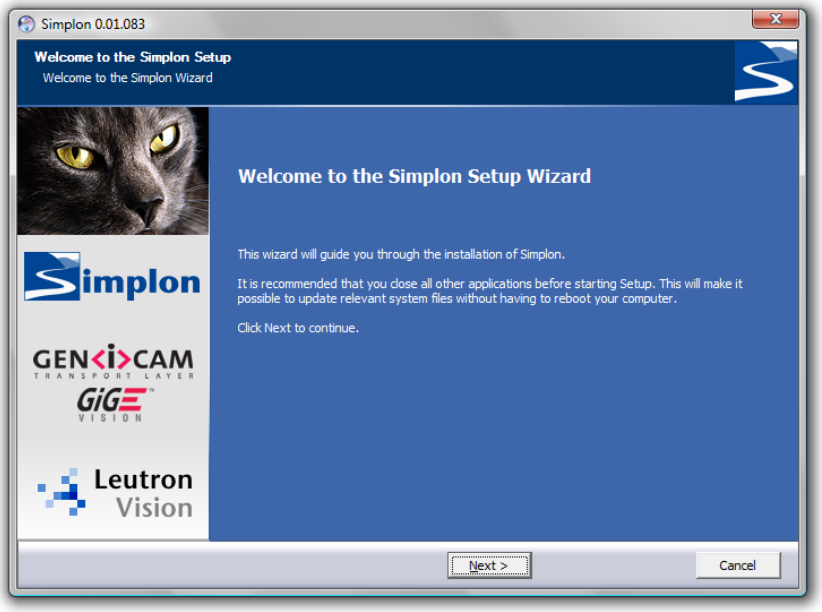
Simplon 0.01.083
Welcome to the Simplon Setup
Welcome to the Simplon Wizard
Welcome to the Simplon Setup Wizard
This wizard will guide you through the installation of Simplon.
It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.
Click Next to continue.
Simplon
GEN<i>CAM
GiGE VISION
Leutron Vision
Next >
Cancel

*Figure 4.2. Simplon installation: welcome screen*

Next screen is the license agreement. Please read carefully the license text and if you agree, click the I Agree button to proceed with installation. Once confirmed, your full agreement with the license text is assumed.

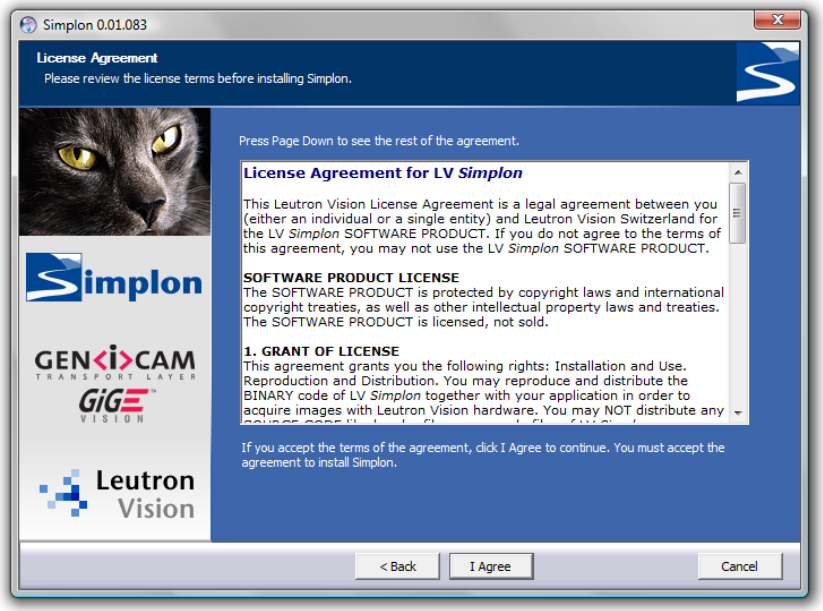
Simplon 0.01.083
License Agreement
Please review the license terms before installing Simplon.
Press Page Down to see the rest of the agreement.
License Agreement for LV Simplon
This Leutron Vision License Agreement is a legal agreement between you (either an individual or a single entity) and Leutron Vision Switzerland for the LV Simplon SOFTWARE PRODUCT. If you do not agree to the terms of this agreement, you may not use the LV Simplon SOFTWARE PRODUCT.
SOFTWARE PRODUCT LICENSE
The SOFTWARE PRODUCT is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties. The SOFTWARE PRODUCT is licensed, not sold.
1. GRANT OF LICENSE
This agreement grants you the following rights: Installation and Use. Reproduction and Distribution. You may reproduce and distribute the BINARY code of LV Simplon together with your application in order to acquire images with Leutron Vision hardware. You may NOT distribute any
If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install Simplon.
Simplon
GEN<i>CAM
GiGE VISION
Leutron Vision
< Back
I Agree
Cancel

*Figure 4.3. Simplon installation: license agreement*

Next the installer asks you about the location where to install Simplon. The default location `C:\Program Files\Leutron Vision\Simplon` should do well in most cases. If you prefer to install Simplon in another directory, select it now. When finished, click the Next button.

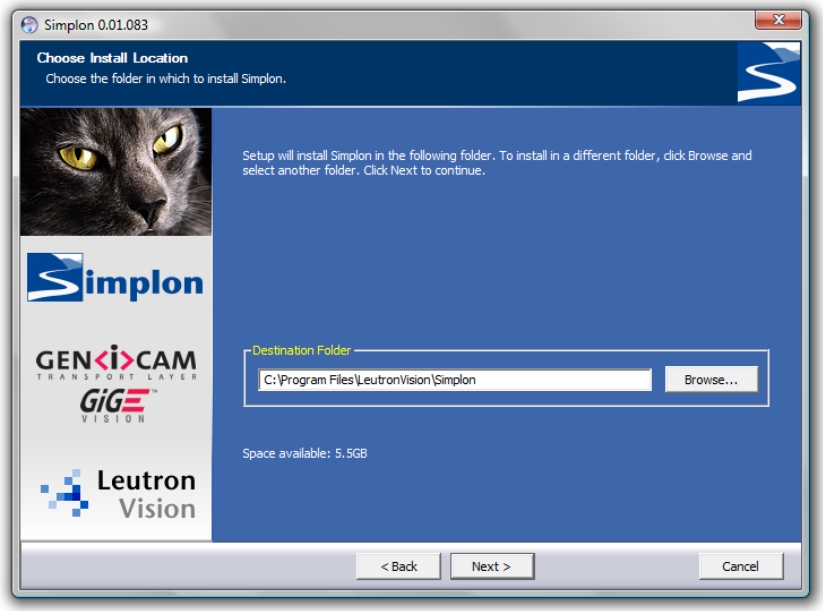
Simplon 0.01.083
Choose Install Location
Choose the folder in which to install Simplon.
Setup will install Simplon in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.
Destination Folder
C:\Program Files\LeutronVision\Simplon
Browse...
Space available: 5.5GB
Simplon
GEN<i>CAM
GiGE VISION
Leutron Vision
< Back
Next >
Cancel

*Figure 4.4. Simplon installation: destination directory*

If running Windows Vista or newer Windows version, the default software installation directory (`C:\Program Files`) is read only for regular applications. Simplon, however, requires write access for certain files during operation (Section 4.1.1.4, “Installation layout” [p. 55]). Therefore the installer will ask you where to put the application data requiring write access.

*Note that in Windows versions older than Windows Vista (in particular in Windows XP) the `C:\Program Files` area is not protected and therefore all data can go to a single directory. Also, when installing to a non-standard location (outside `C:\Program Files`), the installer assumes the user chooses a writable*

*area and installs everything to that directory. The dialog will be omitted in these cases.*

You can choose from three options:

- `C:\Users\Public\LeutronVision\Simplon` — recommended, when Simplon will be used by multiple users.
- `C:\Users\`*`YourUserName`*`\AppDAta\Local\LeutronVision\Simplon` — recommended, when Simplon will be used by a single user (you).
- User configured directory — if none of the options above fit your requirements, you can specify another directory. Be sure the directory has write access for all applications and is not protected by UAC.

Select the preferred option and click Next.

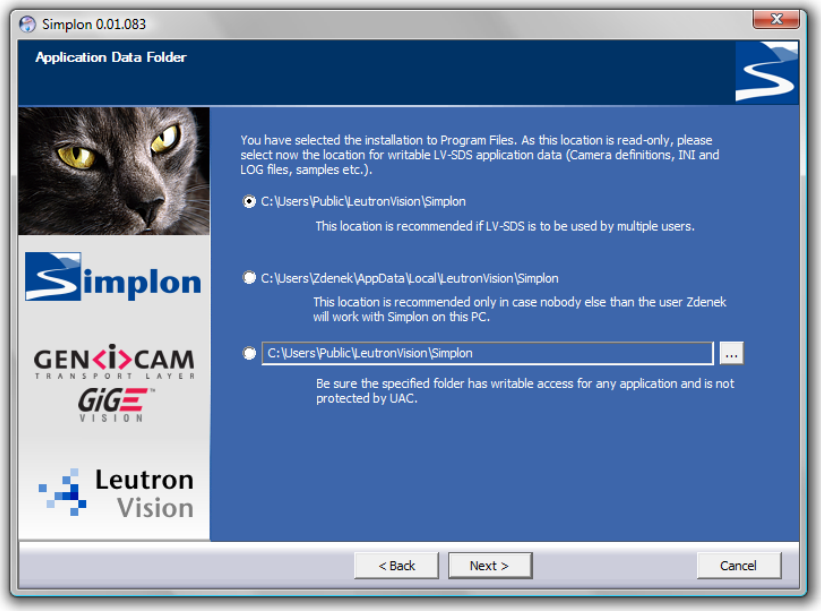
Simplon 0.01.083
Application Data Folder
You have selected the installation to Program Files. As this location is read-only, please select now the location for writable LV-SDS application data (Camera definitions, INI and LOG files, samples etc.).
C:\Users\Public\LeutronVision\Simplon
This location is recommended if LV-SDS is to be used by multiple users.
C:\Users\Zdenek\AppData\Local\LeutronVision\Simplon
This location is recommended only in case nobody else than the user Zdenek will work with Simplon on this PC.
C:\Users\Public\LeutronVision\Simplon
Be sure the specified folder has writable access for any application and is not protected by UAC.
Simplon
GEN<i>CAM
TRANSPORT LAYER
GiGE VISION
Leutron Vision
< Back
Next >
Cancel

*Figure 4.5. Simplon installation: application data directory*

In the next step you can select the Simplon components to install. The set of actual options can slightly differ among individual Simplon versions. The basic options are:

- Runtime files — files necessary to run every Simplon application, these are always installed.
- Development files — essential files for compiling against Simplon API as well as additional helper files. Files in this category are typically installed only on a development system, but not deployed with final runtime systems.
  - Include and library files — required for building Simplon API applications.
  - Sample code
- Documentation — full documentation set for Simplon package and all Leutron Vision camera families.

Note that for testing the cameras, the “runtime” components suffice. However, for programming with Simplon you need to make sure the Developer's tools are installed as well. When finished with the selection, click Install.

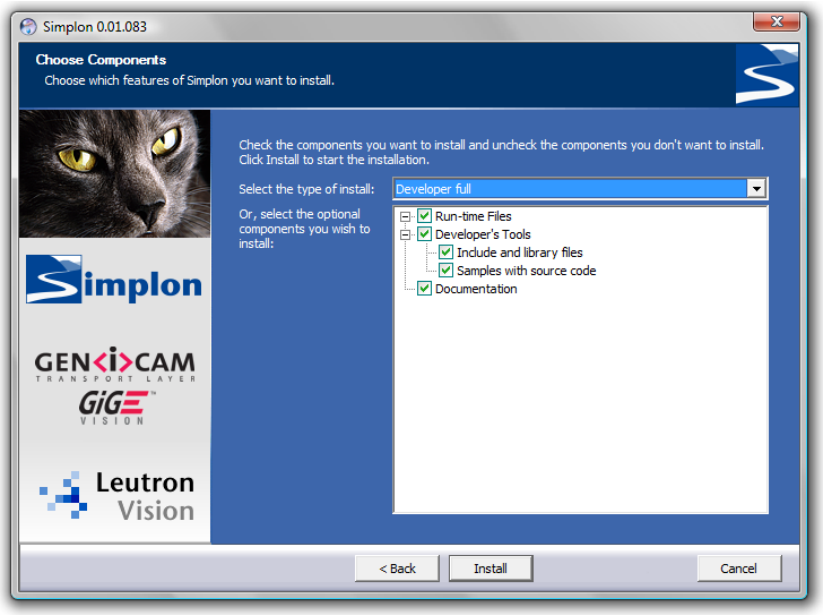


*Figure 4.6. Simplon installation: selecting components*

After starting the installation, the selected components will be installed to your computer. The installer will inform you about the progress. Note that the installation includes also Microsoft Visual Studio runtime redistributable, device driver for CheckSight cameras and network filter driver for GigE Vision based cameras (PicSight-GigE/PicSight-Smart).

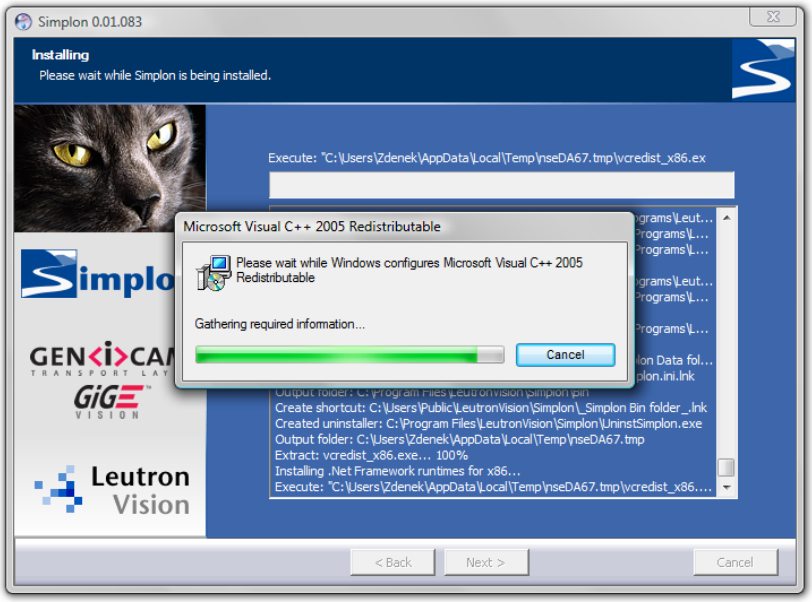


*Figure 4.7. Simplon installation: installation progress*

When completed, the installer displays the final dialog. We recommend to keep the default option (Reboot now) and click Finish. After rebooting, Simplon is ready to use.

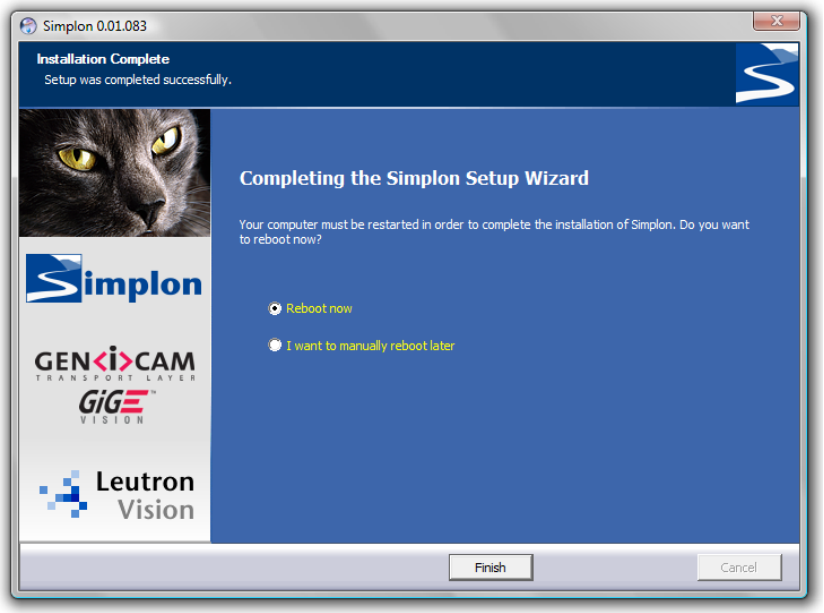


*Figure 4.8. Simplon installation: finising installation*

### 4.1.1.4. Installation layout

As mentioned above, the Simplon files are installed to two destinations, the main directory and the application data directory. For the older Windows versions (Windows XP), these two are merged and the application data directory is actually equivalent to the `bin` subdirectory of the main installation destination.

#### Main installation directory

The main installation directory contains the following subdirectories:

- `backup` — backup of user modified files (such as the configuration files) that might be overwritten when upgrading to newer Simplon version
- `bin` — all executable (`*.exe`) and library (`*.dll` files belonging to Simplon
- `data` — tool-specific data, eg. templates used by the Simplon Source Code Generator
- `doc` — documentation files
- `drivers` — drivers (CheckSight device driver, network filter driver)
- `include` — header files for Simplon API development
- `lib` — library (`*.lib`) files for Simplon API development
- `samples` — additional sample code (most of the samples can be, however, generated interactively using the Simplon Source Code Generator)

#### Application data directory

The application data directory contains following main components:

- `lv.simplon.ini` — Simplon configuration file.
- `lv.simplon.log` — Simplon log file.
- `XML` — contains static XML files copied during installation. None of the files in this directory should be removed unless being explicitly adviced by our support team.
- `XMLCache` — contains GenICam XML files downloaded from cameras.
- `Cache` — preprocessed versions of the GenICam XML files for performance improvement. These can be safely removed, Simplon will re-generate them upon next use.
- `Debug` — the `.pdb` files with debugging information for the Simplon libraries. These might be useful for troubleshooting when contacting our support team.

### 4.1.1.5. Installing network filter driver under Windows

The Simplon setup program can install the network filter driver automatically, if desired. The decision can be made on the setup program's dialog window, where installation components are selected. If not installed automatically, it is still possible to install the filter driver manually later, as described below.

Before installing it, you might want to learn more information about the filter driver [p. 80].

*In older Simplon versions the setup did not install the filter driver automatically and the user was required to install it manually.*

#### Manual filter driver installation

The instructions below describe, how to install the network filter driver manually, if you did not enable it during installation of the Simplon itself. Note that the instructions below assume that Simplon is already successfully installed in the system.

Open the `Network Connections` applet in the Control Panel.

Windows 7 — menu Start → Control Panel → Network and sharing center → Manage Network Connection

Windows Vista — menu Start → Control Panel → Network and internet → Network and sharing center → Manage Network Connection

Windows XP — menu Start → Settings → Control Panel → Network Connections

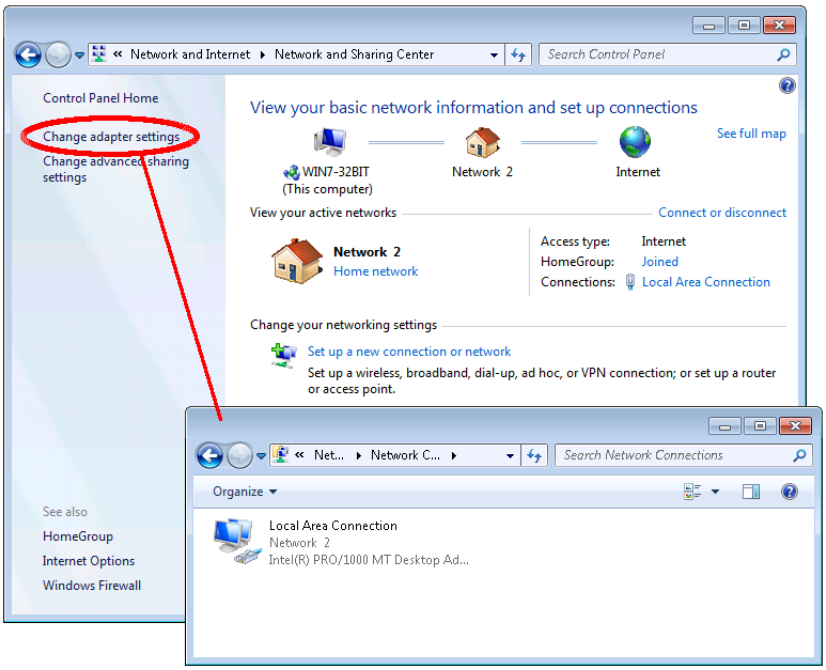


*Figure 4.9. Windows 7, Installing the network filter driver, step 1*

Click with the right mouse button on the network connection, which is used to connect the PicSight-GigE cameras, select Properties from the context menu.

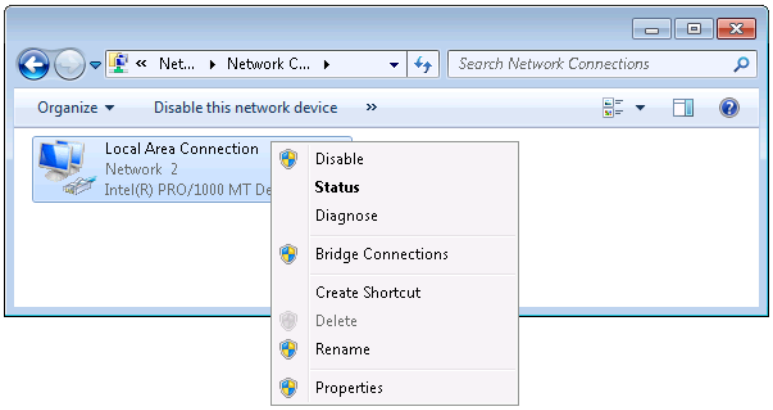


*Figure 4.10. Windows 7, Installing the network filter driver, step 2*

In the Properties dialog box, General tab select Install... button to start the installation.

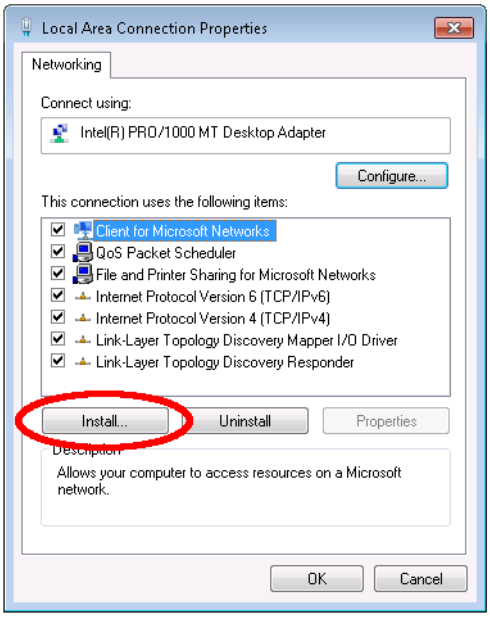


*Figure 4.11. Windows 7, Installing the network filter driver, step 3*

The Select Network Component Type dialog box appear. Select Service as the new network component type and click the Add... button.

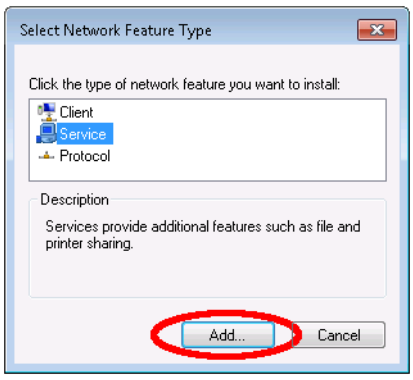


*Figure 4.12. Windows 7, Installing the network filter driver, step 4*

In the Select Network Service dialog box ignore the options possibly offered by the system and click the Have Disk... button to specify the driver location.

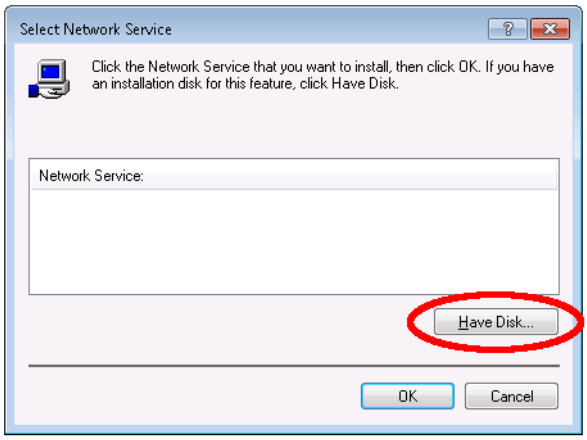
Select Network Service
Click the Network Service that you want to install, then click OK. If you have an installation disk for this feature, click Have Disk.
Network Service:
Have Disk...
OK
Cancel

*Figure 4.13. Windows 7, Installing network filter driver, step 5*

In the next dialog browse to the location where the filter driver files are stored. The directory is *SIMPLONHOME*\drivers\Windows32, where *SIMPLONHOME* is Simplon installation directory, C:\Program Files\Leutron Vision\Simplon by default. When located,click Next.

*For 64-bit Windows the driver files are located in SIMPLONHOME\drivers\Windows64.*

*The driver consists of 4 files that should in any case be available to the system in the same directory (that you need to locate in the dialog as described above). The files are: LvGevDrv.sys (the driver executable itself), the LvGevDrv.inf (the file used to install/uninstall the driver), the LvGevDrv_m.inf (auxiliary) and the LvDrv.cat with a digital signature.*

Windows should successfully find the proper driver and offer it for installation as “Leutron Vision Simplon Filter Driver”. Select that option and click the OK button. Depending on Simplon and Windows versions used one or more dialogs might appear to inform you that the driver is not tested for Windows compatibility. In such case, just click through them, allowing to finish the installation successfully.

When finished the filter driver will be successfully installed and ready to use. You should see it listed in the Local Area Connection properties dialog box.

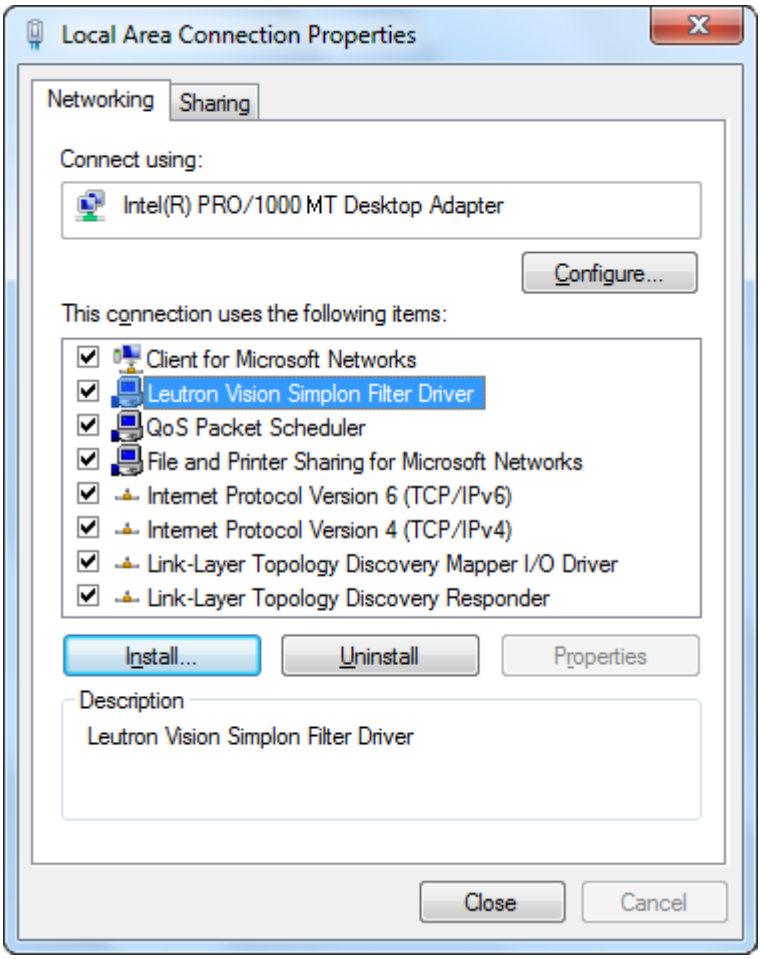


*Figure 4.14. Windows 7, Installing network filter driver, step 6*

## 4.1.2. Installation in Linux

This section discusses Simplon package installation under Linux with notes specific for the most popular distributions and overview of system requirements.

### 4.1.2.1. Installation package types

Linux world does not have a single standard way for software installation. The Simplon Linux package is therefore distributed in multiple forms to suit all systems.

**RPM format**

- Used on most commercial distributions and their community variants, including Fedora/Red Hat, OpenSUSE/SUSE or Mandriva.
- The package file name is `simplon-x.yy.zzz.rpm`, where `x.yy.zzz` stands for Simplon version.
- To install, execute `rpm -i simplon-x.yy.zzz.rpm` with superuser privileges.
- To uninstall, execute `rpm -e simplon` with superuser privileges.

**DEB format**

- Used on Debian based distributions, including Debian, Ubuntu (and variants) or Mint.

- The package file name is `simplon-x.yy.zzz.deb`, where *x.yy.zzz* stands for Simplon version.
- To install, execute `dpkg -i simplon-x.yy.zzz.deb` with superuser privileges.
- To uninstall, execute `dpkg -r simplon` with superuser privileges.

**Compressed archive (TARGZ)**

- The `.tar.gz` archive is intended for systems, where the rpm/deb formats cannot be used or when a customized installation is required for serious reasons. Details are provided in a separate section.

### 4.1.2.2. System requirements

Following list enumerates the most important requirements for installing and using Simplon. Note that the list might not be complete and is subject to change between Simplon versions.

- Kernel version: kernels of the 2.6 line. The oldest tested version to date is 2.6.18, Simplon is kept aligned with all the newest kernel version.
- Compiler: g++/gcc 4.1 and newer, libstdc++ v. 6 (GLIBCXX 3.4.5), pthreads implementation NPTL.
- When installing on CheckSight, the kernel driver needs to get compiled and configured, therefore the basic infrastructure for kernel development needs to be available, in particular the basic compiling tools (gcc and make) and kernel headers. The name of the package containing the kernel headers might differ among individual distributions (eg. `linux-headers`, `kernel-devel` or similar).

  Additional system requirements might apply for CheckSight systems, if in doubt, contact us to get full list of distributions supported by the CheckSight cameras.
- LSB compatibility and xdg-utils are advantage, but they come by default on most of the usual distributions.
- To compile samples genrated by the Simplon Source Code Generator, one needs basic development tools (make, g++) plus packages for Xlib/Xt development.

### 4.1.2.3. Standard installation layout

The Simplon installation follows the Filesystem Hierarchy Standard. Its files are distributed in several directories.

**Main installation direcotry**

The main isntallation directory is `/opt/simplon`.

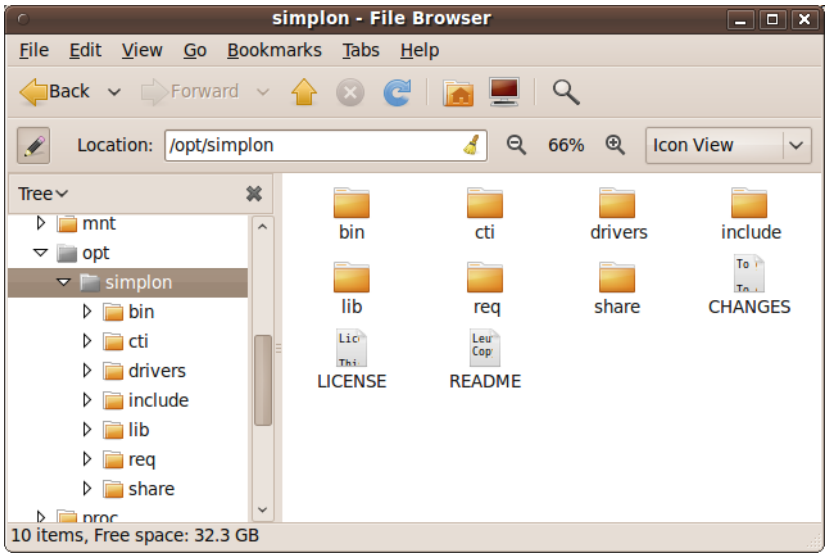


*Figure 4.15. Linux installation layout, main directory*

The main installation directory contains all the runtime binaries and development files. It is organized in following subdirectories:

- `bin` — tools and test/demo programs, in particular Simplon Explorer (`lv.explorer`) and Simplon Settings (`lv.settings`)
- `lib` — all Simplon API libraries, ie. a directory where the linker should be pointed at; on 64-bit systems the `lib` directory contains the 32-bit versions, while the 64-bit ones reside in `lib64`
- `cti` — contains the Simplon GenTL Producer library; on 64-bit systems the `cti` directory contains the 32-bit versions, while the 64-bit ones reside in `cti64`
- `include` — Simplon API header files
- `share` — static data files used by Simplon
- `share/xml` — static XML files copied during installation
- `req` — foreing requisite components used by Simplon, in particular the GenICam runtime
- `drivers` — scripts and sources necessary to build and install Simplon device drivers (used only on CheckSight systems)

### Configuration files

The configuration files are stored in `/etc/opt/simplon`.

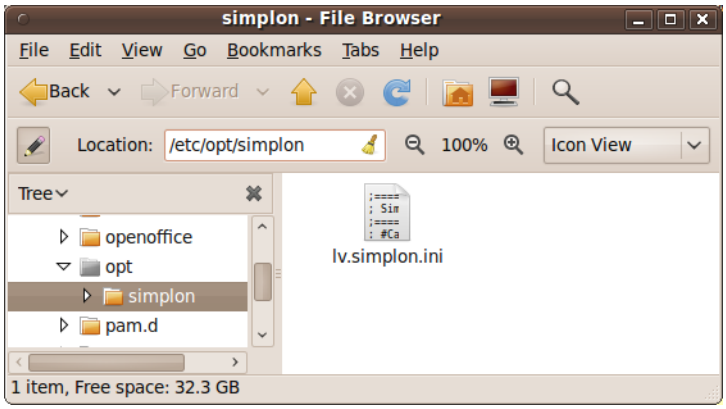


*Figure 4.16. Linux installation layout, configuration files*

The directory contains in particular the main Simplon configuration file, `lv.simplon.ini`. The file should be edited with superuser privileges. See Section 5.7.1, “Simplon Settings utility and the configuration file” [p. 93] for details.

### Application data

The various application data, such as logs and cache go to `/var/opt/simplon`.

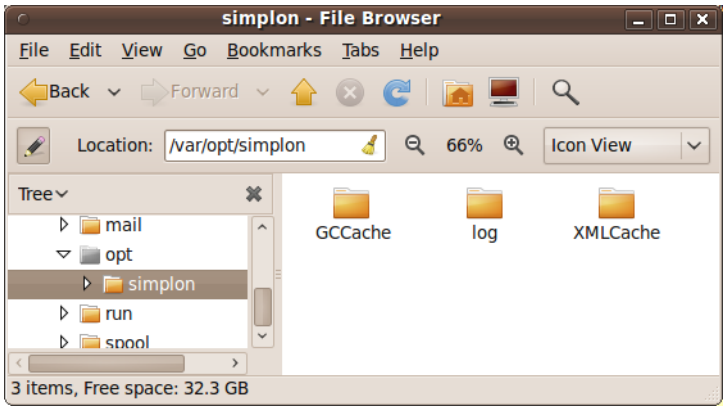


*Figure 4.17. Linux installation layout, application data*

The data are stored in several subdirectories, in particular:

- `log` — default destination for Simplon log files, in particular the `lv.simplon.log`, that are useful for any troubleshooting (refer to Chapter 9, *Troubleshooting & Support* [p. 288]).
- `XMLCache` — contains GenICam XML files downloaded from cameras.
- `GCCache` — preprocessed versions of the GenICam XML files for performance improvement. These can be safely removed, Simplon will re-generate them upon next use.

### User specific files

Possible user specific files (such as demos'/tools' configuration) are stored in `~/.simplon`.

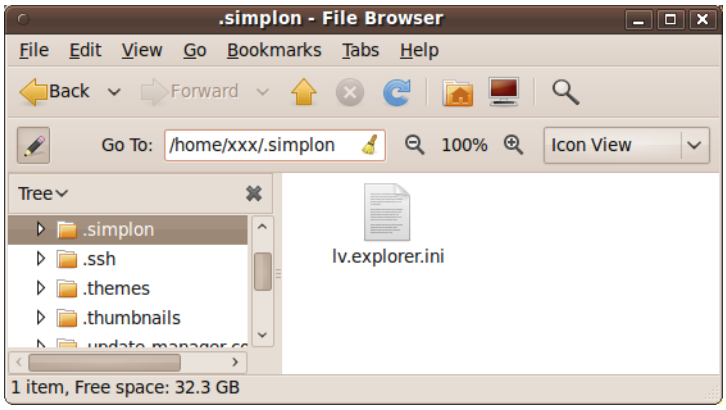


*Figure 4.18. Linux installation layout, user specific data*

This directory is used solely to store user specific settings or preferences for Simplon tools, such as Simplon Explorer or Simplon Settings. It will not be needed for usual operation on a runtime system.

#### Other actions performed by the installer

Besides copying the files and adjusting user rights, the installer performs some additional actions, including:

- When installing on a CheckSight system (detected automatically), the necessary device driver is built and installed.
- For convenience, the directory `/opt/simplon/bin` is added to `PATH` environment variable, so that the tools are directly accessible from the shell. This is performed by adding an entry to `/etc/profile.d` — on systems using other mechanism, the system administrator might need to adjust the path manually.
- Directory `/opt/simplon/cti` is added to the `GENICAM_GENTL32_PATH` environment variable (and analogically the 64-bit variant), so that the Simplon GenTL Producer can be located by 3rd party GenTL consumers. This is performed by adding an entry to `/etc/profile.d` — on systems using other mechanism, the system administrator might need to adjust the path manually.
- For convenience, the directory `/opt/simplon/lib` (and it's 64-bit variant) is added to the search path of the dynamic linker. This is performed by adding an entry to `ld.so.conf.d` — on systems using other mechanism, the system administrator might need to adjust the path manually.

#### Custom installations

Installation to other than default locations is possible, however we recommend to do that only for well-legitimate reasons. Corresponding guidelines are provided in a separate section.

### 4.1.2.4. Notes for the most common distributions

The Simplon package is tested with the most popular distributions. Brief notes for those distributions are listed below. Note that this list by no means suggests that other distributions are not supported, Simplon should work on any system fulfilling the basic requirements (Section 4.1.2.2, “System requirements” [p. 60]). Also the versions listed for each distribution are just a hint, showing which was the original version used for tests. Each newer version of given distribution should work well and older versions would work if fulfilling the mentioned system requirments.

For each distribution, the tests were done with the most basic “default” setup including X, but without any special additions.

*The notes below are related only to Simplon itself, assuming the Linux operating system was properly installed and configured. Special requirements related to operating system installation might apply on CheckSight systems —. To install Simplon on CheckSight, kernel development infrastructure (gcc, make, kernel headers) must be installed to succesfully build and configure the device driver.*

#### Ubuntu

- Originally tested version: 9.10 (Karmic Koala)
- Packaging type: deb format
- Works out of the box

#### Debian

- Originally tested version: 5.0 (Lenny)
- Packaging type: deb format
- Works out of the box

#### OpenSUSE (community version of SUSE Linux Enterprise)

- Originally tested version: 11.2
- Packaging type: rpm format

- Default installation switches on a paranoid firewall, which has to be configured (or switched off) if working with GigE Vision cameras (PicSight-GigE/PicSight-Smart)

**Fedora (community version of Red Hat Enterprise Linux)**

- Originally tested version: 12 (Constantine)
- Packaging type: rpm format
- Default installation switches on a paranoid firewall, which has to be configured (or switched off) if working with GigE Vision cameras (PicSight-GigE/PicSight-Smart)

**Mandriva**

- Originally tested version: 2010.0
- Packaging type: rpm format
- Default installation switches on a paranoid firewall, which has to be configured (or switched off) if working with GigE Vision cameras (PicSight-GigE/PicSight-Smart)

**Slackware**

- Originally tested version: 13
- Packaging type: special (tgz based), but slackware has a tool rpm2tgz which can be used to convert the rpm package (`rpm2tgz simlpon-x.yy.zzz.rpm`) and then install it (`installpkg simplon-x.yy.zzz.tgz`)
- Works out of the box

**Gentoo**

- Originally tested version: 10.1
- Packaging type: special, no reasonable way to use the rpm/deb packages, need to use the tar.gz package

**Mint**

- Originally tested version: 8 (Helena)
- Packaging type: deb format
- Works out of the box

# 5. Initial configuration and preparation

## 5.1. Network configuration

### 5.1.1. Network equipment

The PicSight-GigE is fully compatible with the industry-standard Ethernet LAN equipment.

It can be connected directly to the host PC (point-to-point connection). In such case a cross over cable must be used and the cable length can be up to 100 meters. Note that in case of multiple Ethernet adapters in the host PC, each one must be configured with a different subnet.

Or it can be connected to a network with one or more switches between the PicSight-GigE and the host PC. As the PicSight-GigE complies with the IP protocol standard, it should work with all standard Ethernet switches. However, the functions and performance grade of the switch can significantly influence the performance of the image transfer and thus care must be taken in order to select an appropriate switch.

For optimal performance the network with the Gigabit Ethernet (1000BASE-T) components should be used. In the host PC it is recommended to use a network adapter (NIC) with the Intel PRO/1000 chipset, including its native device driver.

Using shielded (S/STP) cables rated as category 6 or better is highly recommended to achieve good performance over long distance cables.

The switch should be non-blocking, it should support “Jumbo Frames” and have memory buffers of sufficient size. The particular requirements for switch specification strongly depend on the way how the PicSight-GigE cameras will be used in the system — how many cameras will be connected, if they will transfer images simultaneously and in which speed, etc. Refer also to Section 5.2, “Network performance” [p. 72].

To achieve sufficient and especially predictable performance, it is recommended to dedicate a network segment solely for the image acquisition, avoiding additional network traffic (such as internet or office) that would interfere with the image acquisition.

### 5.1.2. Possible impact of a firewall

If the host PC has a firewall software running and you experience troubles with the connection or data transfer, the firewall should be the first thing to check.

The firewall is a software which filters packets coming from the network and thus it can block some of the communication channels used by PicSight-GigE. So it can happen, for example, that although the `ping` command succeeds, the PicSight-GigE is not accessible via the HTTP protocol (the firewall has disabled access to machines on local network for web browsers). Similarly, it can happen that you can access PicSight-GigE through HTTP, you can even discover, connect and configure the camera but when starting acquisition, the images are not transferred to the application — this can happen when the firewall blocks the data sent from the camera through the UDP protocol.

Note also that the usage of the firewall software adds some CPU overhead which might degrade the throughput of the LAN.

The easiest attitude is to switch the firewall fully off. However, this can be recommended only for debugging or in situations, when the PC is not vulnerable to network attacks (for example, if you use the PC's network interface only to connect the camera). If the PC is connected to a network and especially to the internet, switching the firewall off is not a good idea; you should rather configure the firewall so that it remains active, but enables the communication with PicSight-GigE.

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Preferrably one or more network cards will be dedicated solely for camera connection — then firewall can be disabled for these connections and stay active only for network connections handling the non-camera network traffic, such as internet.

### 5.1.2.1. Configuration of Windows XP Firewall

The example shown in this chapter describes the configuration of the Windows Firewall that is by default installed on Windows XP SP2. The situation is similar with firewalls delivered with other flavors of Windows.

If you need to keep the firewall switched on, you have to configure it in a way that it does not block the communication with PicSight-GigE camera. In Windows Firewall this is done using “exceptions”(any incoming connections are prohibited, except those defined by the exceptions). To configure it, start the Windows Firewall applet in the menu Start → Settings → Control Panel.

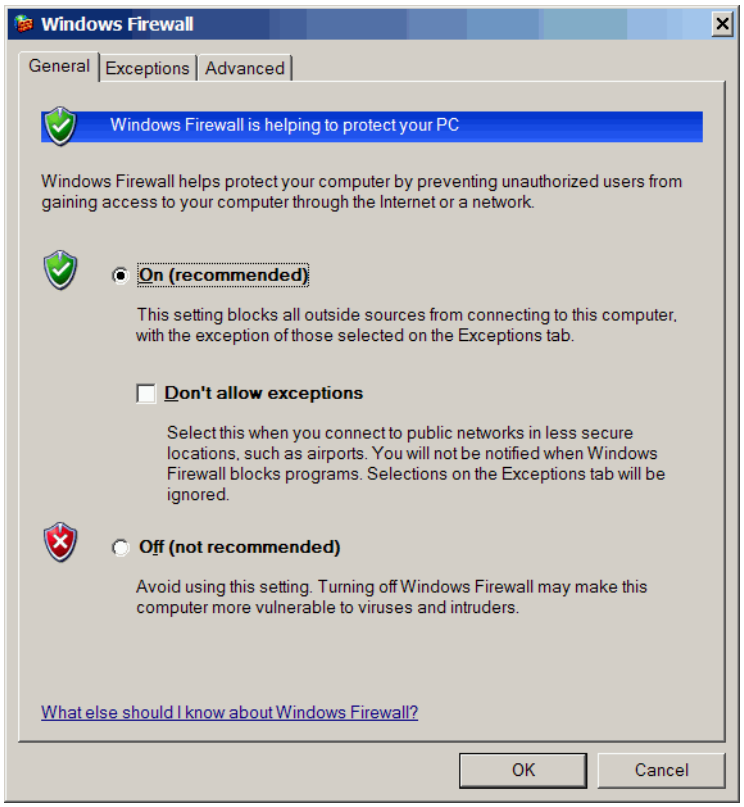

Windows Firewall
General
Exceptions
Advanced
Windows Firewall is helping to protect your PC
Windows Firewall helps protect your computer by preventing unauthorized users from gaining access to your computer through the Internet or a network.
On (recommended)
This setting blocks all outside sources from connecting to this computer, with the exception of those selected on the Exceptions tab.
Don't allow exceptions
Select this when you connect to public networks in less secure locations, such as airports. You will not be notified when Windows Firewall blocks programs. Selections on the Exceptions tab will be ignored.
Off (not recommended)
Avoid using this setting. Turning off Windows Firewall may make this computer more vulnerable to viruses and intruders.
What else should I know about Windows Firewall?
OK
Cancel

*Figure 5.1. Windows Firewall, general settings*

If the network connections used for connecting the cameras are not shared with other network traffic (which is recommended practice), than you can switch off the firewall for those connections, and keep it on only for the connections handling the “regular” network traffic. This can be done in the Advanced tab of the firewall configuration window.

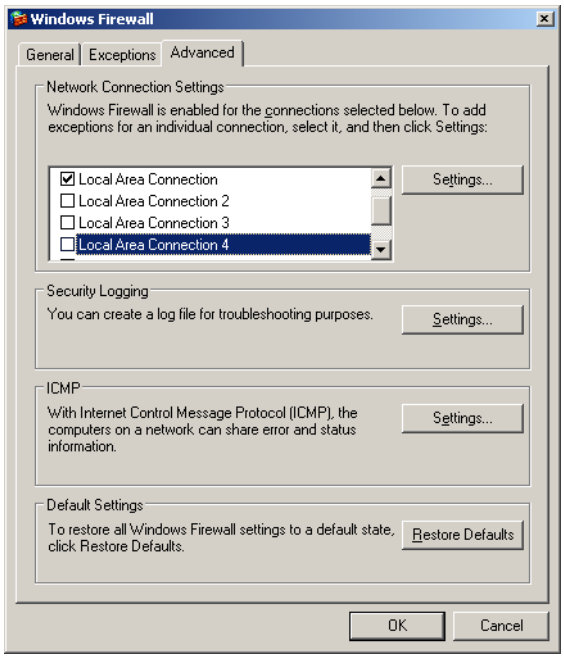

Windows Firewall
General
Exceptions
Advanced
Network Connection Settings
Windows Firewall is enabled for the connections selected below. To add exceptions for an individual connection, select it, and then click Settings:
Local Area Connection
Local Area Connection 2
Local Area Connection 3
Local Area Connection 4
Settings...
Security Logging
You can create a log file for troubleshooting purposes.
Settings...
ICMP
With Internet Control Message Protocol (ICMP), the computers on a network can share error and status information.
Settings...
Default Settings
To restore all Windows Firewall settings to a default state, click Restore Defaults.
Restore Defaults
OK
Cancel

*Figure 5.2. Windows Firewall, advanced settings — firewall disabled for selected network connecitons*

If the connection must be shared with other traffic and the firewall needs to stay on, you will have to add exceptions to the firewall configuration, allowing the image acquisition traffic. Make sure the Don't allow exceptions checkbox is not checked…

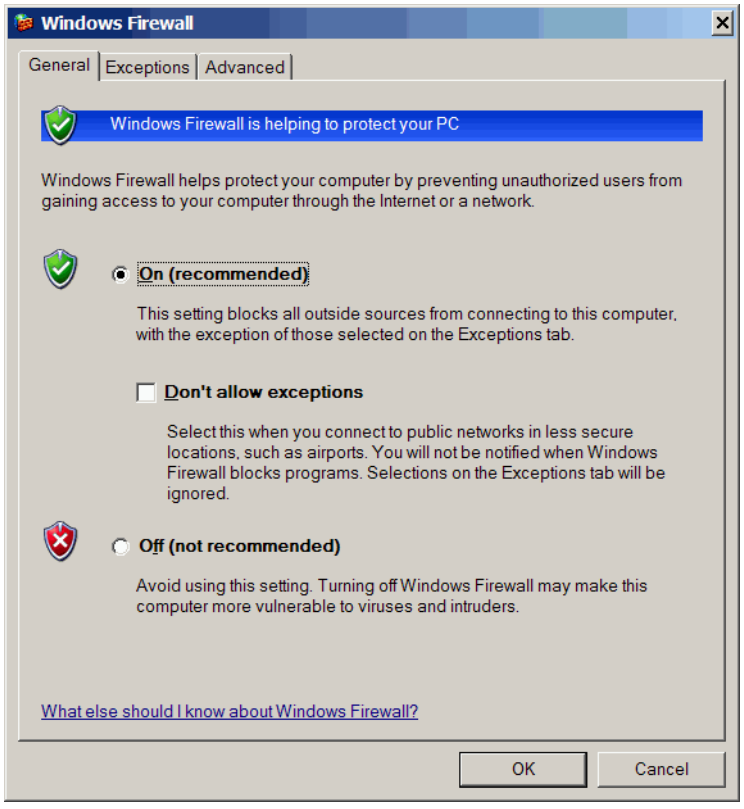

Windows Firewall
General
Exceptions
Advanced
Windows Firewall is helping to protect your PC
Windows Firewall helps protect your computer by preventing unauthorized users from gaining access to your computer through the Internet or a network.
On (recommended)
This setting blocks all outside sources from connecting to this computer, with the exception of those selected on the Exceptions tab.
Don't allow exceptions
Select this when you connect to public networks in less secure locations, such as airports. You will not be notified when Windows Firewall blocks programs. Selections on the Exceptions tab will be ignored.
Off (not recommended)
Avoid using this setting. Turning off Windows Firewall may make this computer more vulnerable to viruses and intruders.
What else should I know about Windows Firewall?
OK
Cancel

*Figure 5.3. Windows Firewall, exceptions allowed*

… and switch to the Exceptions tab of the firewall configuration window. Click Add Program... button and locate the Simplon Explorer program. Then click OK to add the Simplon Explorer in the exceptions' list. Since now incoming communication will not be blocked for Simplon Explorer. Repeat the same procedure for any other executables (including programs you compile yourself) you want to use for acquisition from the PicSight-GigE camera.

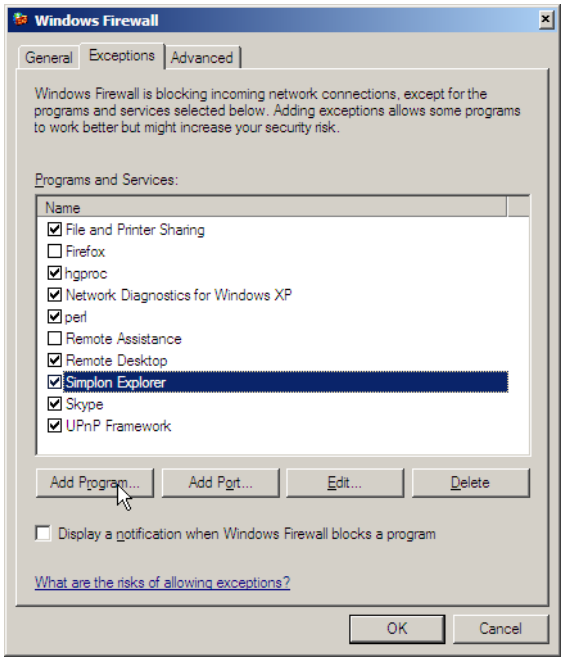



*Figure 5.4. Windows Firewall, adding an exception*

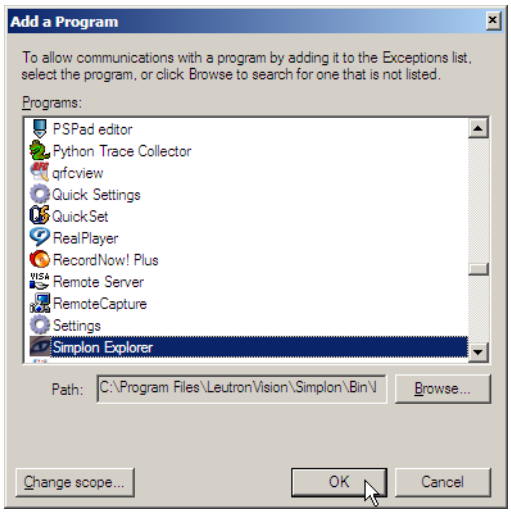



*Figure 5.5. Windows Firewall, exception for Simplon Explorer*

If you like to be more secure, you can restrict this exception to the subnet only or even to a specific list of IP addresses (corresponding with IP addresses of your PicSight-GigE cameras). Proper dialog for this configuration will appear after clicking the Change scope... button.

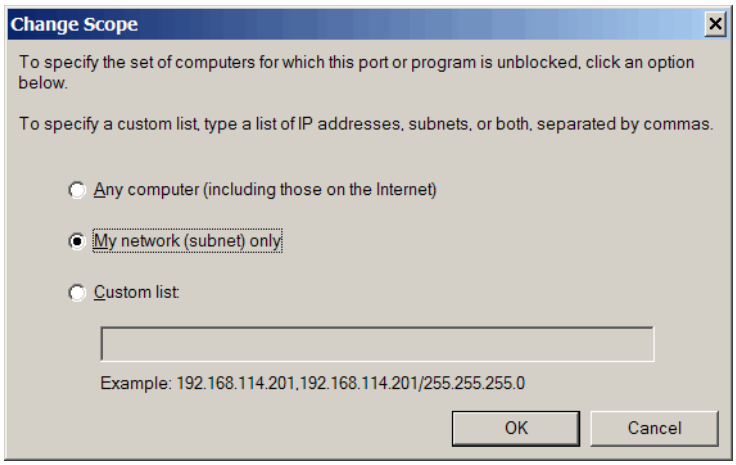

Change Scope
To specify the set of computers for which this port or program is unblocked, click an option below.
To specify a custom list, type a list of IP addresses, subnets, or both, separated by commas.
Any computer (including those on the Internet)
My network (subnet) only
Custom list:
Example: 192.168.114.201,192.168.114.201/255.255.255.0
OK
Cancel

*Figure 5.6. Windows Firewall, changing scope for an exception*

### 5.1.2.2. Configuration of other firewalls

If your system uses any other firewall, its configuration should be very similar to the XP one, depending on its design philosophy.

If you have a firewall that allows more detailed configuration, for example configuring also outgoing connections, make sure that no restrictions are made for outgoing HTTP connections (so that you are able to configure the PicSight-GigE camera using your web browser), for `ping`, and in case you will need to access PicSight-GigE over FTP, than make sure also that no restrictions apply for outgoing FTP.

### 5.1.2.3. Firewall configuration under Linux

On many Linux distributions, the firewall is switched off by default, since no ports are anyway opened after a basic installation. In such case no special actions are needed. Other distributions switch the firewall on — and then you will have to configure it properly to allow the image acquisition traffic. The basic principles how to achieve that will be same as described above for the Windows systems. The individual distributions frequently provide own front-ends allowing to configure the firewall — refer to the documentation of your Linux distribution.

Alternatively to the distribution specific frontends, the firewall can be configured directly through the low-level `iptables` interface. The iptables configuration allows wide range of complex and flexible rules defining the firewall behavior and requires corresponding level of expertise to be done properly. Its documentation is beyond scope of this manual, if needed, please refer to the iptables documentation, preferably with notes specific to your particular distribution.

To perform a basic check if any firewall is active on your system, you can query the current iptables settings, executing the `iptables -L` command with superuser privileges. If no firewall is active (all communication accepted), the output of the command would look similar as

```
Chain INPUT (policy ACCEPT)
target     prot opt source               destination

Chain FORWARD (policy ACCEPT)
target     prot opt source               destination

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination
```

## 5.1.3. Checking the connection

As required by the GigE Vision standard, the default off-factory configuration of the PicSight-GigE cameras starts in the DHCP/LLA mode. If a DHCP server is running in the network, the camera will obtain the IP address through the DHCP protocol. If the DHCP procedure fails, the camera falls back to the LLA (link-local address) scheme.

*The cameras using the firmware version 1.x (the "legacy mode", Section 2.5, "GigE Vision compatible and legacy boot modes" [p. 25]) do not start with DHCP configuration, but rather with a fixed IP address* `192.168.1.55`*, subnet mask* `255.255.0.0`*.*

This configuration can be adjusted (eg. switching to a fixed IP address for the camera) either through the Simplon GigE Vision Configuration Tool (Section 5.6, "Simplon GigE Vision Configuration Tool" [p. 90]) or directly through the feature tree in Simplon Explorer (Section 6.4.2, "Selected GigE Vision related features" [p. 103]).

The fastest way to verify connection is using the Simplon GigE Vision Configuration Tool. When starting, the tool will search for the GigE Vision cameras connected to the system and displays them in a list. All the cameras directly accessible to the system will be displayed with a green icon.

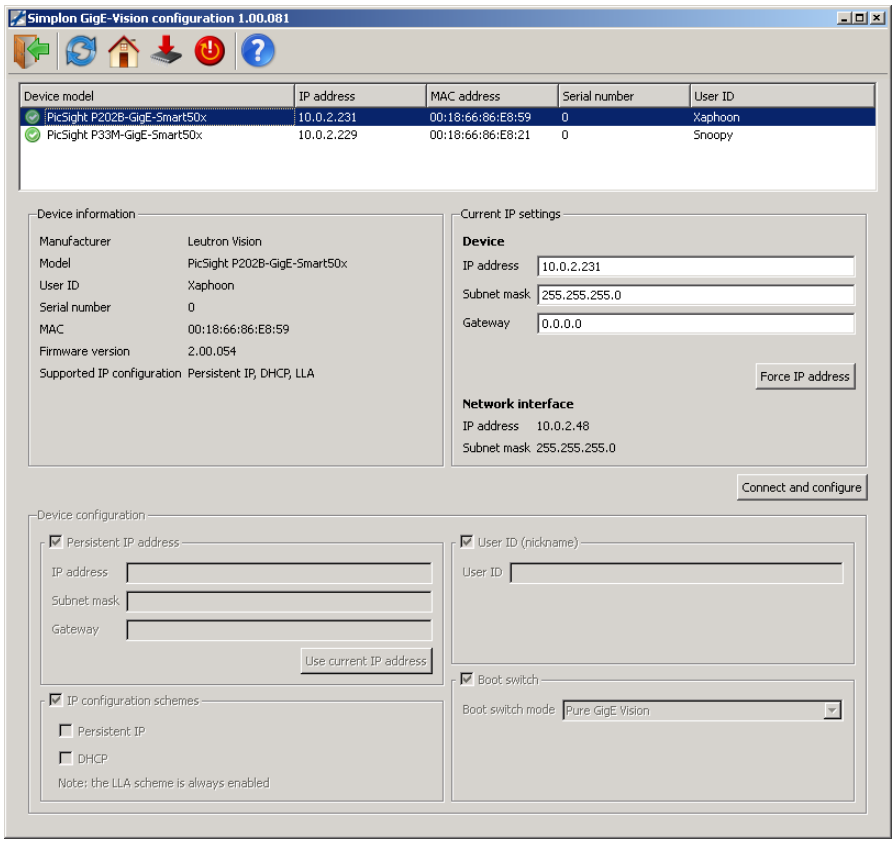



*Figure 5.7. Simplon GigE Vision Configuration Tool*

Red icon would mean that the camera is being used by another application (possibly even from another PC) and is thus locked. Yellow icon means the camera is visible, but not directly accessible, typically because its IP configuration does not match with the network card through which it is connected — the two are configured for different subnets. In such case the temporary or even persistent IP address of the camera can be immediately adjusted from the Simplon GigE Vision Configuration Tool. The full details of the Simplon GigE Vision Configuration Tool configuration options are documented in Section 5.6, "Simplon GigE Vision Configuration Tool" [p. 90].

Once the camera is directly accessible (green icon in Simplon GigE Vision Configuration Tool), it is ready to be connected from Simplon Explorer or any other GigE Vision compatible application.

### 5.1.3.1. Network card's IP configuration

Sometimes it might necessary to modify IP configuration of the network card itself to match the desired system configuration.

#### Windows

To modify the IP configuration under Windows, open Start → Settings → Control Panel → Network Connections → Local Area Connection → Properties → Internet Protocol (TCP/IP) → Properties:

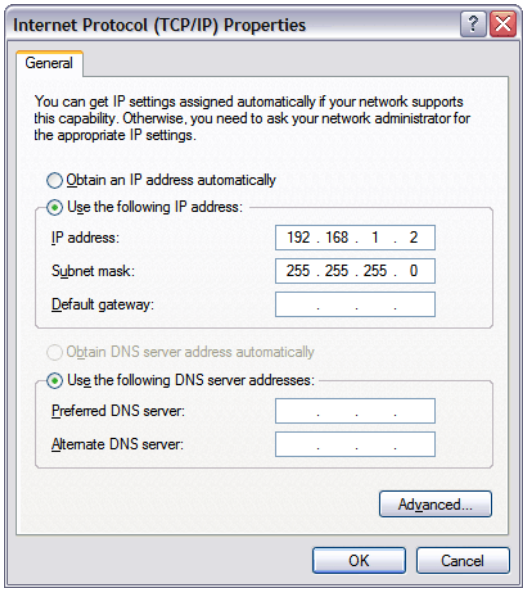

Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 1 . 2
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

*Figure 5.8. Setting network IP properties*

Choose between automatic (DHCP) configuration and a fixed IP address. For a fixed settings, specify the desired IP address itself and the subnet mask. Optionally set also the default gateway.

#### Linux

To adjust the IP configuration under Linux, you can use commands `ifconfig` and `route`, for example:

```
ifconfig eth0 10.0.2.48 netmask 255.255.255.0
route add default gw 10.0.2.100
```

To make the settings permanent, including selection of the IP configuration scheme (DHCP versus persistent address), individual Linux distributions provide different front-end tools for network configuration. Also the underlying configuration files are distributions specific, eg:

- `/etc/network/interfaces` file on Debian/Ubuntu based systems
- `/etc/sysconfig/network-scripts` directory on Fedora and related systems
- `/etc/sysconfig/network` directory on OpenSuse and related systems

Please refer to the documentation of your system for details.

# 5.2. Network performance

When using GigE Vision cameras in demanding applications, involving high stress of the entire system, one needs to consider and possibly tune system parameters, such as CPU load associated with acquisition from the Ethernet based cameras, about the system latency (and especially its predictability) and reliability. With basic understanding of the networking technology and with elementary care for the important factors, the mentioned parameters can be successfully controlled.

This chapter will discuss the most important aspect of the problem. A very detailed paper describing all aspects of network performance connected with using GigE Vision cameras, such as PicSight-GigE is available from Leutron Vision. The paper can be downloaded from our website[1].

## 5.2.1. Conditions affecting the performance

The image data are streamed from the camera to the PC using the UDP protocol. In case some of the packets is not delivered in time, it is lost, unless the application asks the camera explicitly to resend them. Depending on the data rate produced by the camera and number of connected cameras, the network as well as the receiving PC are exposed to corresponding processing load. There are several points on the data path which might incur performance problems.

- When connecting multiple cameras over a switch, it is important to consider the amount of data the cameras can produce simultaneously if acquiring in parallel. If the data volume exceeds the bandwidth of the link between the switch and the PC or if the data exceed the switch's forwarding capability, packets might be lost.
- When the data reach the host PC, they are processed by the network card driver and the operating system's network stack. Depending on the overall load of the PC (number of interrupts generated, PCI bus load, processor load), the packet processing might not be fast enough to cope with the incoming data and some packets might get dropped again.
- If the network connection is shared for image acquisition and other traffic (such as internet connection), the other traffic might affect the image acquisition performance — and especially the performance might become unpredictable.
- When a “slower” link (100Mbit) appears on the data path between the camera and PC, but the camera itself is connected to the switch using a Gigabit Ethernet link, the camera will not know about the bottleneck, relaying the data in full speed. The data would get dropped on the slow link.

The following sections will provide advice how to cope with the mentioned problems.

## 5.2.2. Packet size, jumbo frames

The size of the packets carrying the image data is adjustable. It has direct impact on the processing load induced by the packet stream processing on the receiving PC.

When using low packet size, more packets are required to transfer the image. Higher number of packets means more network card interrupts, more packet processing in the network stack as well as by the application itself. Higher number of packets means also higher overhead, since every packet is carrying some header data. Increasing the packet size can eliminate all this unnecessary overhead.

It is, however, important to remember that the standard maximal Ethernet packet size is 1500 bytes. To use packets of higher than standard packet size (so called “jumbo frames”), it is necessary that the network card and all components (switches) on the data path support and are configured

[1] http://www.leutron.com/products/products-for-machine-vision-and-image-acquisition-digital-c/picsight-gigabit-ethernet-camera/network-performance/

to recognize given packet size. If the network card or switch is not compatible with the jumbo frames, a standard packet size under 1500 bytes has to be used.

The packet size feature can be found in the feature tree in category *Transport Layer Control* (Section 6.4, “Transport layer control” [p. 102]), under the *Stream Channel Selector*. The feature is accessible in the “expert” feature visibility level. The GenICam name of the feature is `GevSCPSPacketSize`. The default value is chosen to be compatible with all the standard Ethernet equipment, ie. within the 1500-byte-per-packet standard limit.

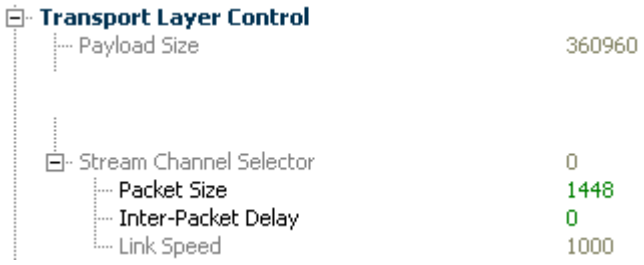



*Figure 5.9. Packet size in the feature tree*

The two figures below demonstrate, how increasing packet size lowers processing load of the receiving PC.

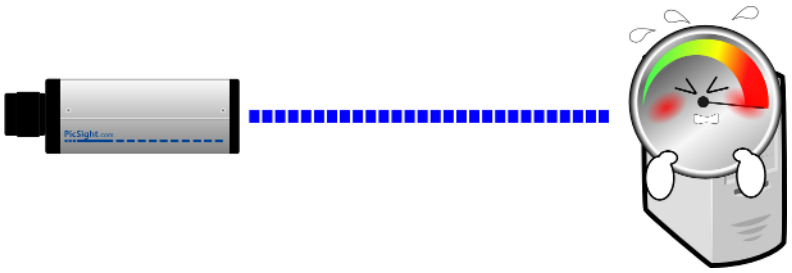


*Figure 5.10. High processing load with small packet size*

*Figure 5.11. Lowered processing load with jumbo frames*

## 5.2.3. Flow control, inter-packet delay

The inter-packet delay is a basic flow control mechanism allowing to limit the packet rate generated by the camera. It is a minimal delay the camera guarantees to insert between each two consecutive packets of the image data stream. Its particular size should be chosen according to the network configuration, number of connected cameras, used frame rate and other parameters. Contact us if you have problems determining the proper settings for your application, our team will provide advice or tools helping to evaluate your setup.

The inter-packet delay can help for example in following situations:

- Multiple cameras connected to a switch are sharing a single network segment up to the receiving PC. If they are relaying simultaneously, the total data rate might exceed the link bandwidth.
- The receiving PC might be heavily loaded, eg. by a critical real-time image processing. In such case the resources reserved for the image processing might be temporarily limited, which could lead to packet losses if the incoming data rate is too high.
- The camera is connected to a gigabit Ethernet network segment, but there's a slower (100Mbit) segment on the data path. The camera would have no way to know about that bottleneck and the packets would get dropped when reaching that segment if the camera transmits with full gigabit speed.

The inter-packet delay feature can be found in the feature tree in category *Transport Layer Control* (Section 6.4, “Transport layer control” [p. 102]), under the *Stream Channel Selector*. The feature is accessible in the “expert” feature visibility level. The GenICam name of the feature is `GevSCPD`. The default value is `0`.

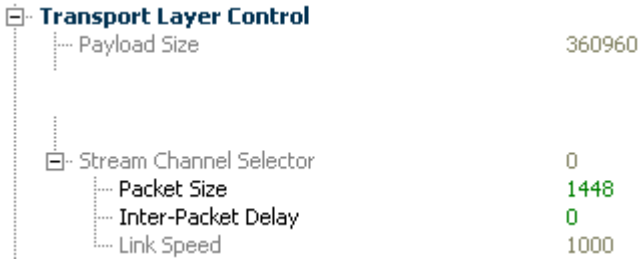



*Figure 5.12. Inter-packet delay in the feature tree*

The two figures below demonstrate, how packet delay should be used if multiple cameras might be transmitting the image data simultaneously, competing for the link to the PC.

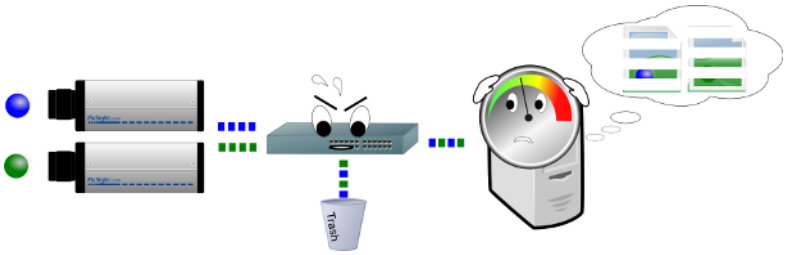



*Figure 5.13. Switch dropping packets from multiple cameras due to bottleneck in the uplink*

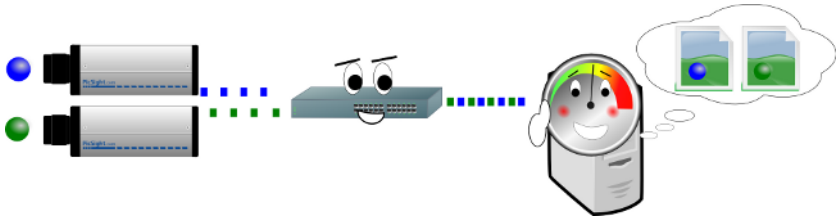


*Figure 5.14. Bottleneck resolved using inter-packet delay*

Another two figures demonstrate how packet delay helps with packet processing in case of a heavily loaded host PC.

*Figure 5.15. Overloaded PC dropping packets in a packet burst*

*Figure 5.16. Packet rate lowered through inter-packet delay*

## 5.2.4. Network card configuration

For optimal performance a network adapter (NIC) based on the Intel PRO/1000 chipset should be used. This section provides information about the possible performance related settings of network cards based on this chipset. Remember to use original and up-to-date device drivers for the network card.

See following screenshots showing the recommended performance-specific configuration options. Note that the screenshots contain also good explanation of every single option, so you should be able to apply similar settings also on another network card, if you cannot use the recommended model for any reason. The screenshots document the configuration options under Windows —corresponding Linux configuration options are described below.

First open the network card properties dialog in the “Device manager”. Select the Advanced tab, option Jumbo Frames. Enable the jumbo frame support. You can select the highest possible packet size value, even if the actual packet size used for the acquisition might be lower. Remember that all the equipment on the data path must support the jumbo frames as well.

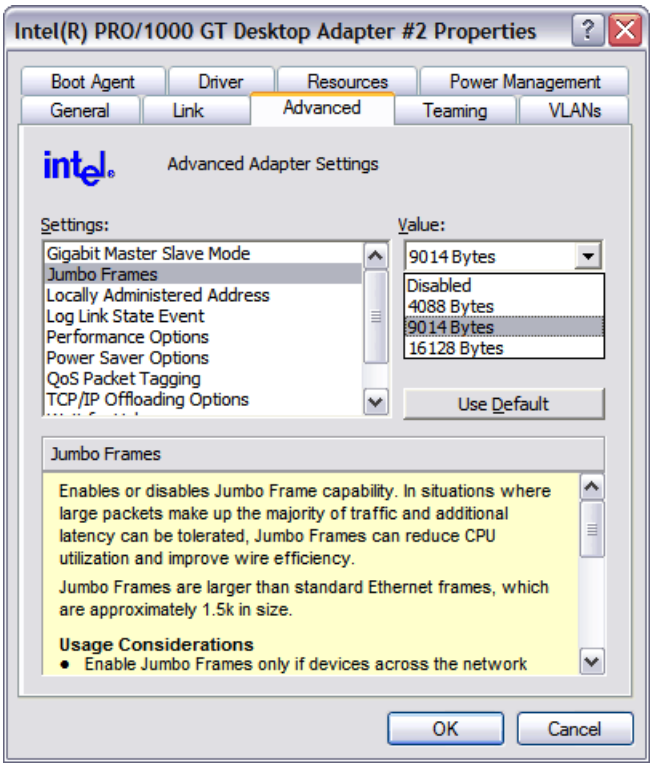



*Figure 5.17. Configuring Intel PRO/1000 GT, Jumbo frames*

Select the Advanced tab, option Performance Options and click the Properties button.

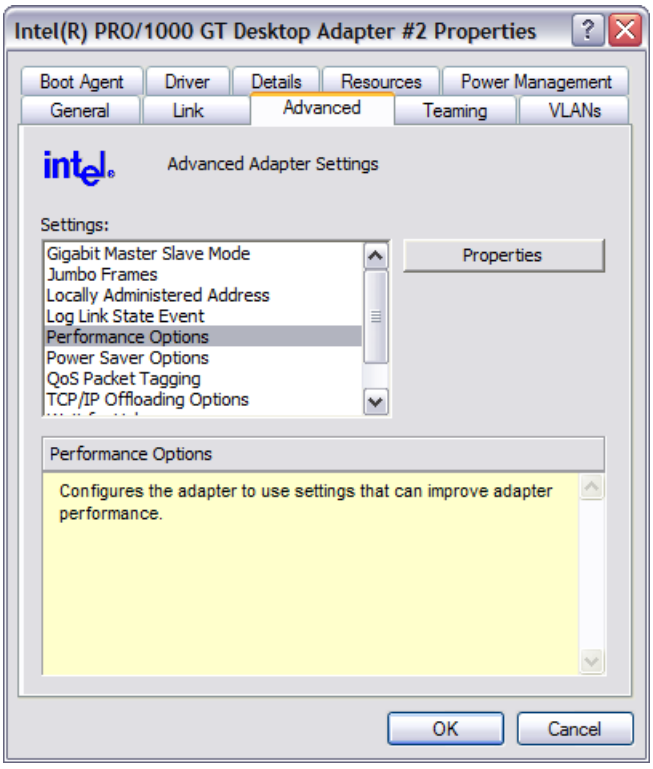



*Figure 5.18. Configuring Intel PRO/1000 GT, Advanced properties*

Another dialog will pop up, allowing to configure some performance specific options. The screenshots below document how all the options should be set up, including corresponding explanations.

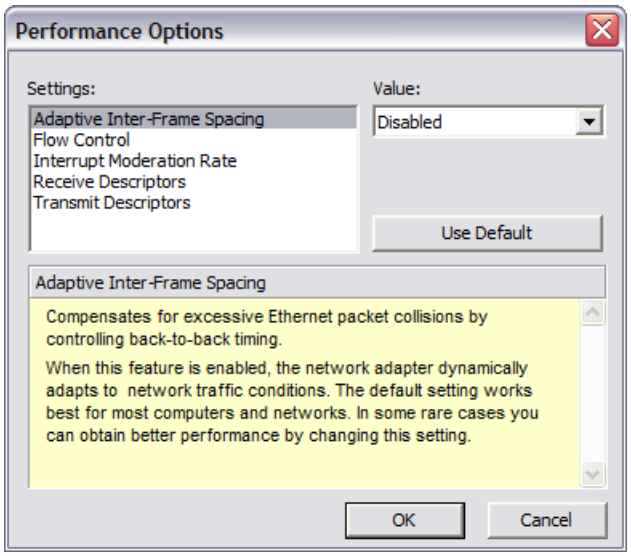

Performance Options
Settings:
Value:
Adaptive Inter-Frame Spacing
Flow Control
Interrupt Moderation Rate
Receive Descriptors
Transmit Descriptors
Disabled
Use Default
Adaptive Inter-Frame Spacing
Compensates for excessive Ethernet packet collisions by controlling back-to-back timing.
When this feature is enabled, the network adapter dynamically adapts to network traffic conditions. The default setting works best for most computers and networks. In some rare cases you can obtain better performance by changing this setting.
OK
Cancel

*Figure 5.19. Configuring Intel PRO/1000 GT, Inter-Frame Spacing*

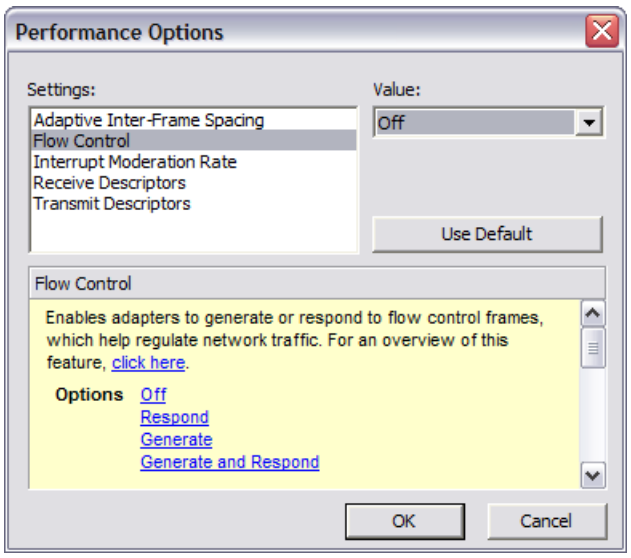



*Figure 5.20. Configuring Intel PRO/1000 GT, Flow Control*

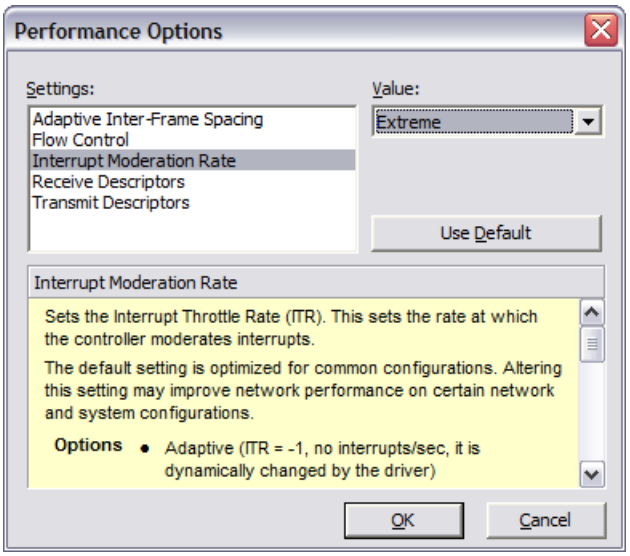

Performance Options
Settings:
Value:
Adaptive Inter-Frame Spacing
Flow Control
Interrupt Moderation Rate
Receive Descriptors
Transmit Descriptors
Extreme
Use Default
Interrupt Moderation Rate
Sets the Interrupt Throttle Rate (ITR). This sets the rate at which the controller moderates interrupts.
The default setting is optimized for common configurations. Altering this setting may improve network performance on certain network and system configurations.
Options
Adaptive (ITR = -1, no interrupts/sec, it is dynamically changed by the driver)
OK
Cancel

*Figure 5.21. Configuring Intel PRO/1000 GT, Interrupt Moderation Rate*

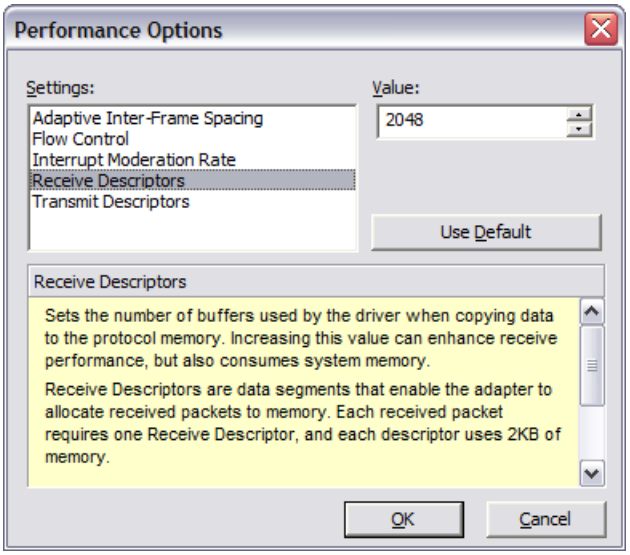

Performance Options
Settings:
Value:
Adaptive Inter-Frame Spacing
Flow Control
Interrupt Moderation Rate
Receive Descriptors
Transmit Descriptors
2048
Use Default
Receive Descriptors
Sets the number of buffers used by the driver when copying data to the protocol memory. Increasing this value can enhance receive performance, but also consumes system memory.
Receive Descriptors are data segments that enable the adapter to allocate received packets to memory. Each received packet requires one Receive Descriptor, and each descriptor uses 2KB of memory.
OK
Cancel

*Figure 5.22. Configuring Intel PRO/1000 GT, Receive Descriptors*

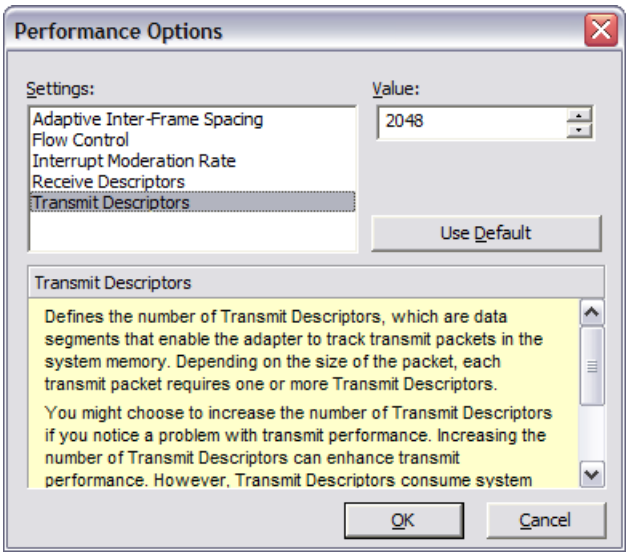

Performance Options
Settings:
Value:
Adaptive Inter-Frame Spacing
Flow Control
Interrupt Moderation Rate
Receive Descriptors
Transmit Descriptors
2048
Use Default
Transmit Descriptors
Defines the number of Transmit Descriptors, which are data segments that enable the adapter to track transmit packets in the system memory. Depending on the size of the packet, each transmit packet requires one or more Transmit Descriptors.
You might choose to increase the number of Transmit Descriptors if you notice a problem with transmit performance. Increasing the number of Transmit Descriptors can enhance transmit performance. However, Transmit Descriptors consume system
OK
Cancel

*Figure 5.23. Configuring Intel PRO/1000 GT, Transmit Descriptors*

#### 5.2.4.1. Linux

The set of the configuration options is similar under Linux. The individual parameters might be adjusted using the `ifconfig` and `ethtool` commands or as options passed at driver module load time (`modprobe`). Let's walk through some examples briefly, assuming all the commands are executed with superuser privileges.

Configure jumbo frame size up to 9000 bytes on interface eth0:

```
ifconfig eth0 mtu 9000
```

Configure number of receive descriptors to the maximum supported size (4096):

```
ethtool -G eth0 rx 4096
```

Query the device driver controlling the network card and its version (should be “e1000” or the newer “e1000e”):

```
ethtool -i eth0
```

The interrupt moderation parameters could be adjusted through the `ethtool -C` command, however this option is not recognized by all driver version. As an alternative, it's possible to require descreasing of the interrupt throttling rate when loading the module (note that the actually suitable value might depend on the use case). Note that the “extreme” interrupt moderation mode setting on the Windows driver corresponds with the interrupt throttle rate value of 1000 for the Linux dirver.

```
modprobe e1000 InterruptThrottleRate=1000 FlowControl=0
```

Disable automatic flow control:

```
ethtool -A eth0 autoneg off rx off tx off
```

To make the discussed settings permanent, edit corresponding network configuration files. The network configuration options are, however, system specific, so please refer to the documentation of your distribution for details. Below you can see a hint for the most popular distributions:

- `/etc/network/interfaces` file on Debian/Ubuntu based systems
- `/etc/sysconfig/network-scripts` directory on Fedora and related systems

- `/etc/sysconfig/network` directory on OpenSuse and related systems

The module loading options might be made permanent through the `/etc/modprobe.conf` configuration file, or a file in the `/etc/modprobe.d` directory, depending on the distribution used.

## 5.2.5. Network filter driver

Streaming video data over a network might lead to quite high network load. When the data has to be fully processed by the common network stack implemented by the operating system, high CPU load on the PC side might be involved. This means that part of the resources needed for image processing is consumed by the acquisition itself. Indirectly, the high system load may even lead to packet dropping. To solve these issues, Leutron Vision delivers a dedicated network filter driver.

The filter driver, when installed, hooks in a low-level point within the network stack and observes all the network communication going through the network card where it is installed. It filters out all the packets related to PicSight-GigE streaming in an effective way and passes them directly to Simplon buffers. All other communication (not related to PicSight-GigE) is passed up to higher levers of the network stack, so that they can reach the expected target. The filter driver thus does not affect any other communication routed through the same network interface.

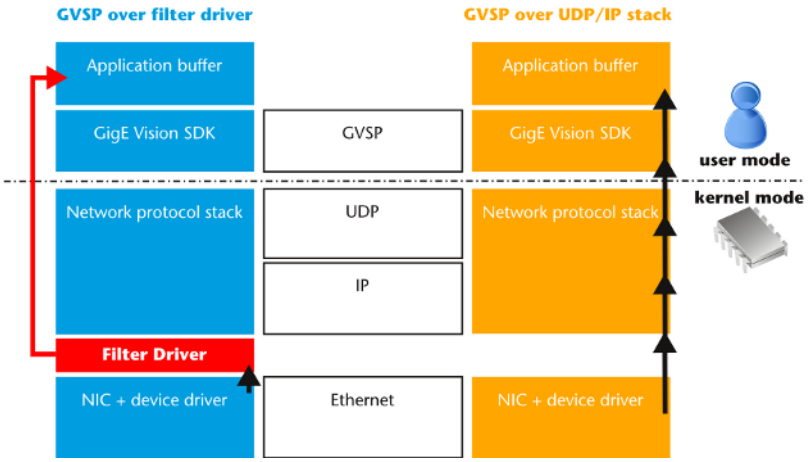



*Figure 5.24. Processing the image data stream using the network filter driver*

It does not replace the network card's driver, but rather allows to communicate with that driver directly than going through the standard network stack. The network stack overhead is thus fully eliminated for the PicSight-GigE streaming.

The filter driver is independent on the network card model an it can be used with any Gigabit Ethernet equipment.

*Using the filter driver might slightly decrease performance of other network traffic (not related to PicSight-GigE cameras) routed over the network card on which the filter driver is applied. This involves configurations where the same network card is used for connecting the camera as well as for other network traffic at the same time (when the camera is connected over a switch). The performance impact is, however, not too high, typically just few percent.*

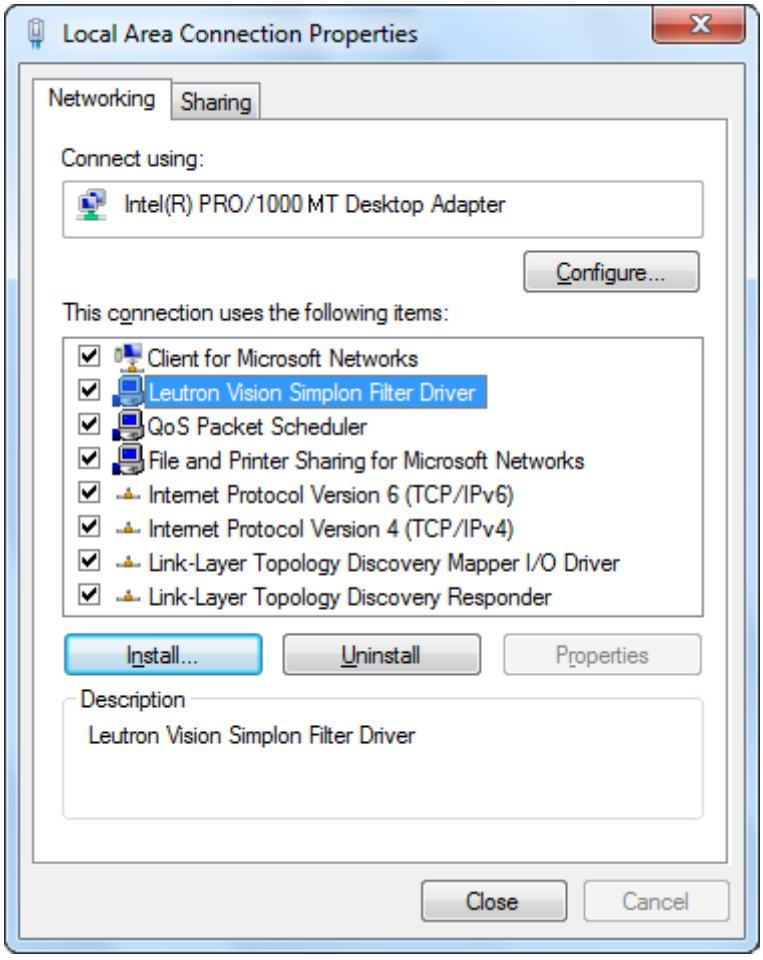
The filter driver is currently available only for Windows operating systems. See Section 4.1.1.5, “Installing network filter driver under Windows” [p. 56], providing information about installation of the filter driver (the driver is installed automatically by default, so the users don't usually need to care about it).

Note that the Simplon filter driver is not used when the camera is accessed from a 3rd party GigE Vision compatible software, bypassing the Simplon GenTL Producer. In such case, please check if the software package you are using provides own filter driver.

### 5.2.5.1. Enabling and disabling the filter driver use

Once installed, the filter driver can be disabled — either globally or per-device.

- After installing the filter driver (Section 4.1.1.5, “Installing network filter driver under Windows” [p. 56]), it can be temporarily disabled in the Properties of each respective network connection — clearing the checkbox for the Leutron Vision Simplon Filter Driver serivce.




- When enabled, it is still possible to configure, whether to use the filter driver for each respective acquisition. The default behavior is configured through the Simplon configuration file and Simplon Settings utility (Section 5.7, “Simplon configuration” [p. 93]) — option GenTL Options → GenTL Device Options → GenTL GEV Device Options → Default use of filter driver.

- The default behavior can be changed on per-device basis through a corresponding feature in the GenTL Device feature tree. The feature name is `LvGevDeviceStreamCaptureMode` (displayed as *Device Stream Capture Mode* in a GUI). It is an enumeration, allowing to select among default behaviour (according to the configuration file described above), “socket acquisition” (filter driver off, acquisition routed through standard network stack), or acquisition using filter driver.

# 5.3. HTTP-based configuration

The PicSight-GigE/PicSight-Smart cameras are running a simple HTTP (web) server allowing to get various information about the camera and adjust its basic properties from any web browser. Note that most of the configuration options can be adjusted also using Simplon GigE Vision Configuration Tool or directly from the camera's feature tree. The advantage of the HTTP interface is that it can be used even at systems, where the Simplon software package is not installed — provided that you know the IP address of the camera.

## 5.3.1. Basic camera information

To connect to the camera's HTTP interface, start your favourite web browser, and type the IP address of the camera. The browser will display a welcome screen showing basic information about the camera, such as its type, serial number, IP/MAC address, nickname (user name) or firmware version.

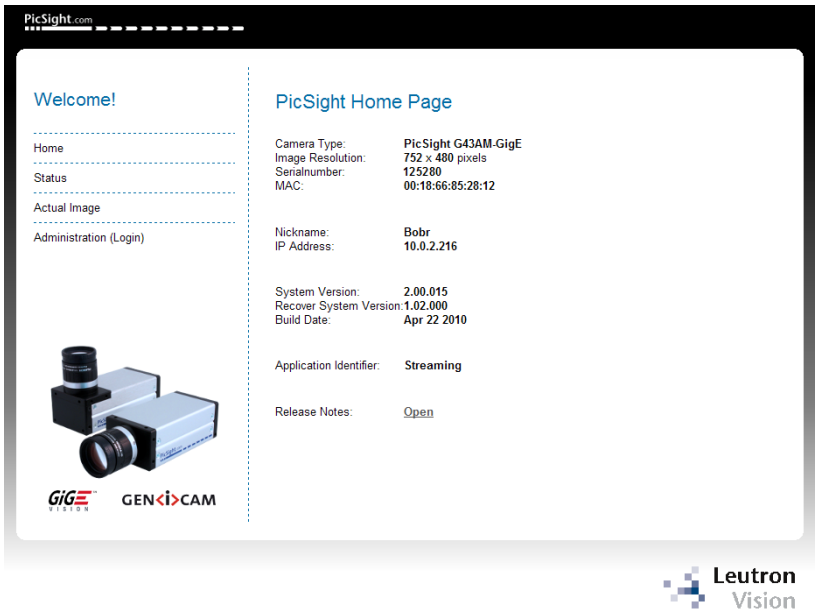



*Figure 5.25. PicSight-GigE HTTP interface: welcome screen*

The left part of the screen offers links to other functions of the HTTP interface.

The “status” page provides information about current status of the camera, in particular the current IP configuration and link speed, as well as the list of supported communication protocols.

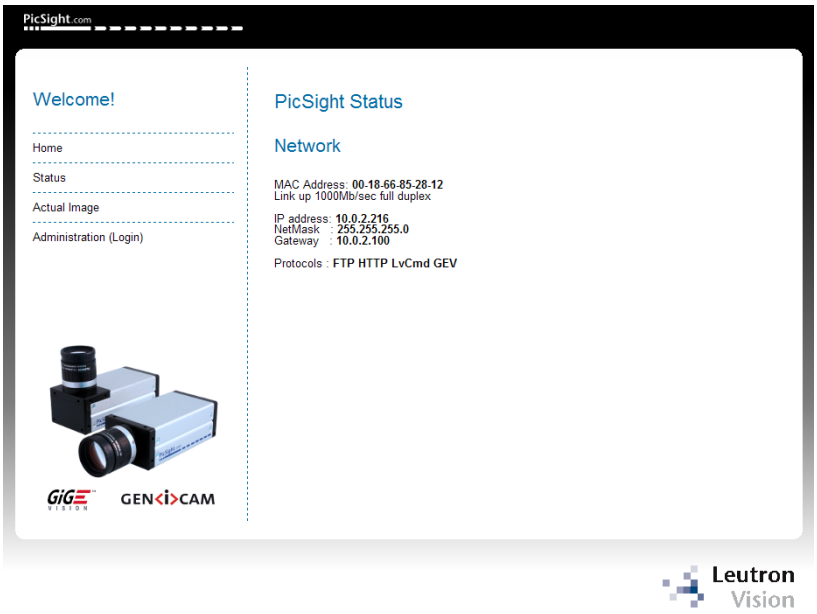



*Figure 5.26. PicSight-GigE HTTP interface: current status*

The “actual image” page displays the current image present in the camera's frame buffer. This can be used to verify the most basic camera functionality during troubleshooting. Note that if the camera is operating in triggered mode, it will be the image acquired upon the last trigger. If the camera started in triggered mode and no trigger was applied yet, you will get just black image.

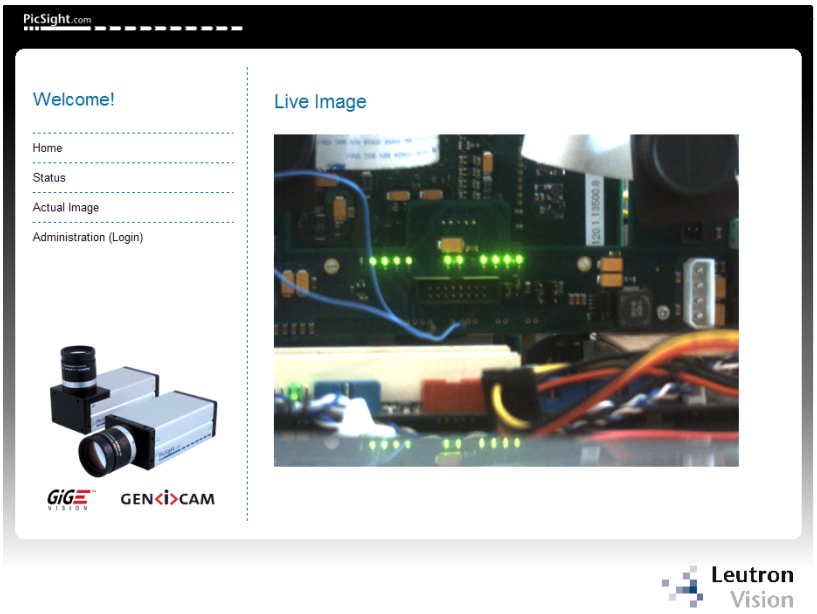



*Figure 5.27. PicSight-GigE HTTP interface: acquired image*

## 5.3.2. Camera administration

To access the configuration options of the camera's HTTP interface, click the Administration link. You will be prompted for access credentials. The default user name is `gige`, password `gige`, the password can be changed (on PicSight-Smart models the default user name is `smart`, password `smart`). After logging in, the “administration” page will be displayed, offering several configuration categories.

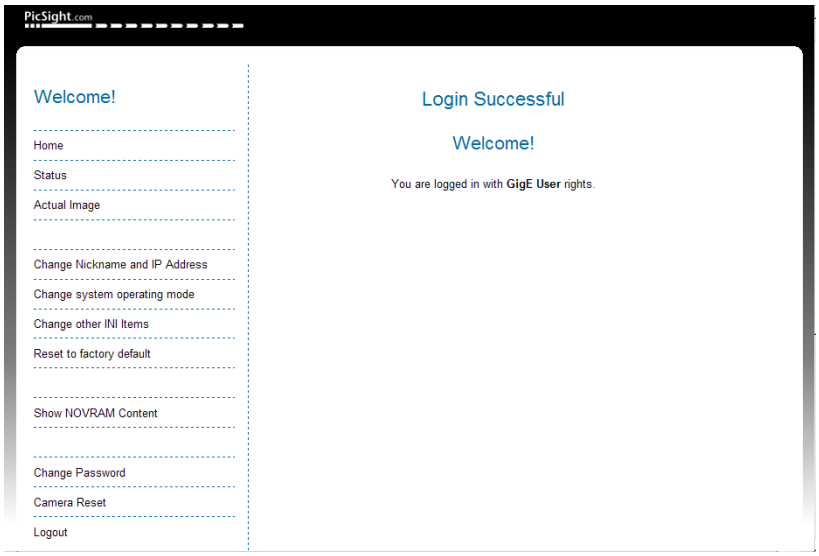



*Figure 5.28. PicSight-GigE HTTP interface: administration options*

The category “Change nickname and IP address” allows to change the nickname (user name) of the camera — a name which can be used to identify/open the camera among the cameras discovered in the network. When working with multiple cameras, it might be good idea to use a unique nickname for each of them.

The same configuration page also allows to adjust camera's IP configuration: IP address, subnet mask and default gateway. Note that when setting the IP address to `0.0.0.0` switches the camera to DHCP/LLA mode.

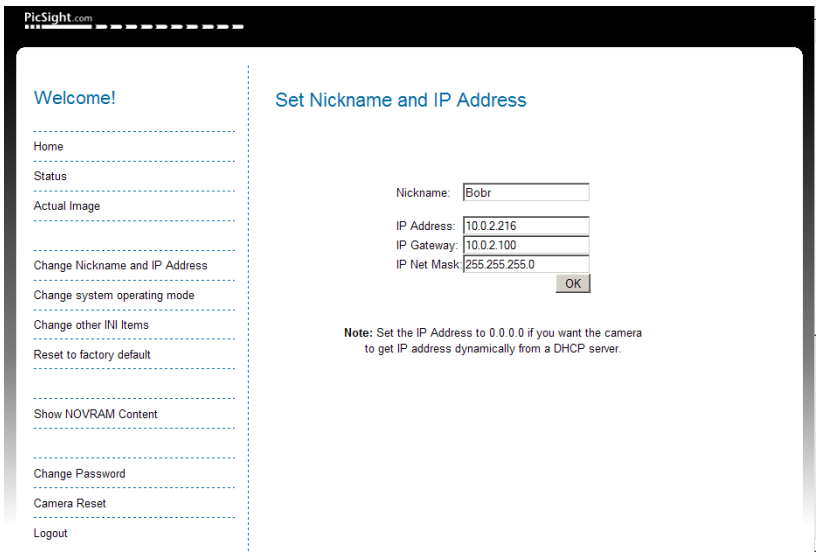



*Figure 5.29. PicSight-GigE HTTP interface: nickname and IP configuration*

The “Change system operating mode” page offers to switch the camera between legacy and pure GigE Vision operating modes. The legacy mode that the camera will start with legacy firmware version (version 1.x), supporting the communication protocol used in our older LV-SDS software package. Use the legacy mode only when the cameras need to work with a LV-SDS application. Note that this firmware line is in maintenance mode, no new features are added.

The “Pure GEV” (pure GigE Vision) mode will load the new (version 2.x) firmware, which is fully compatible with the GigE Vision standard.

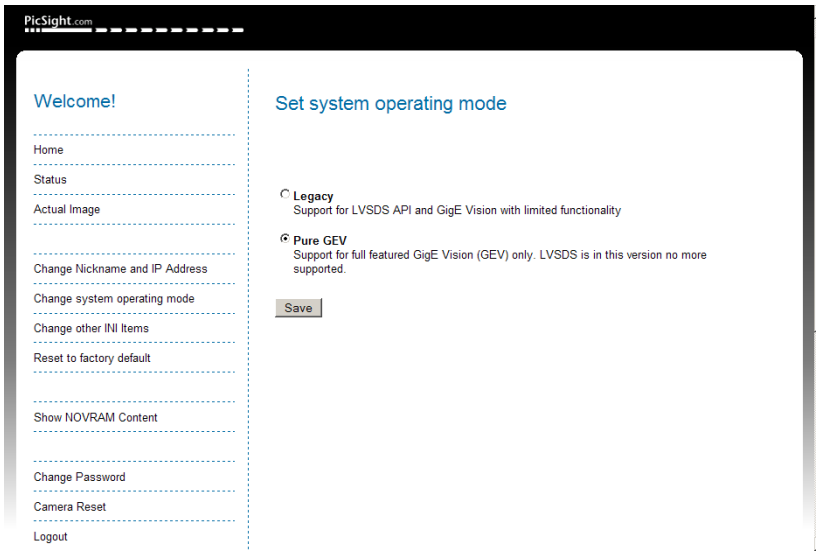



*Figure 5.30. PicSight-GigE HTTP interface: operating mode*

The remaining functions or configuration categories accessible from the camera's administration page include:

| | |
|---|---|
| Change other INI items | Allows to adjust some specific low level parameters. We recommend to not touch them unless being advised by our support personnel. |
| Reset to factory defaults | Resets any previously adjusted options back to defaults. |
| Show NOVRAM content | Displays content's of cameras NOVRAM. This information is intended only for troubleshooting and might be required by our support personnel. |
| Change password | Allows to change the administration password of the camera's HTTP interface. |
| Camera reset | Resets (reboots) the camera. |
| Logout | Logs out of the camera administration space. Note that the authentication data might still be kept by the browser in the current session. To avoid that, you should close the browser window. |

# 5.4. Firmware update

The PicSight-GigE/PicSight-Smart cameras are field upgradeable. The upgrade procedure is simple and can be done using the Simplon GigE Vision Configuration Tool tool (which is more thoroughly documented in Section 5.6, “Simplon GigE Vision Configuration Tool” [p. 90].

The following description assumes that you downloaded the package containing the new firmware from our download area[2] or that you obtained the package from our support staff. The package file name comes in shape `PicSightGige_UpdateMixed_ML_ll_lll-RG_gg_ggg.bin`, where `G_gg_ggg` and `L_ll_lll` stand for firmware version (major, minor and subminor, eg. `2_00_052`) of the two firmware components, the default GigE Vision compatible and the legacy component (the legacy mode will be used only when explicitly configured or when recovering the camera).

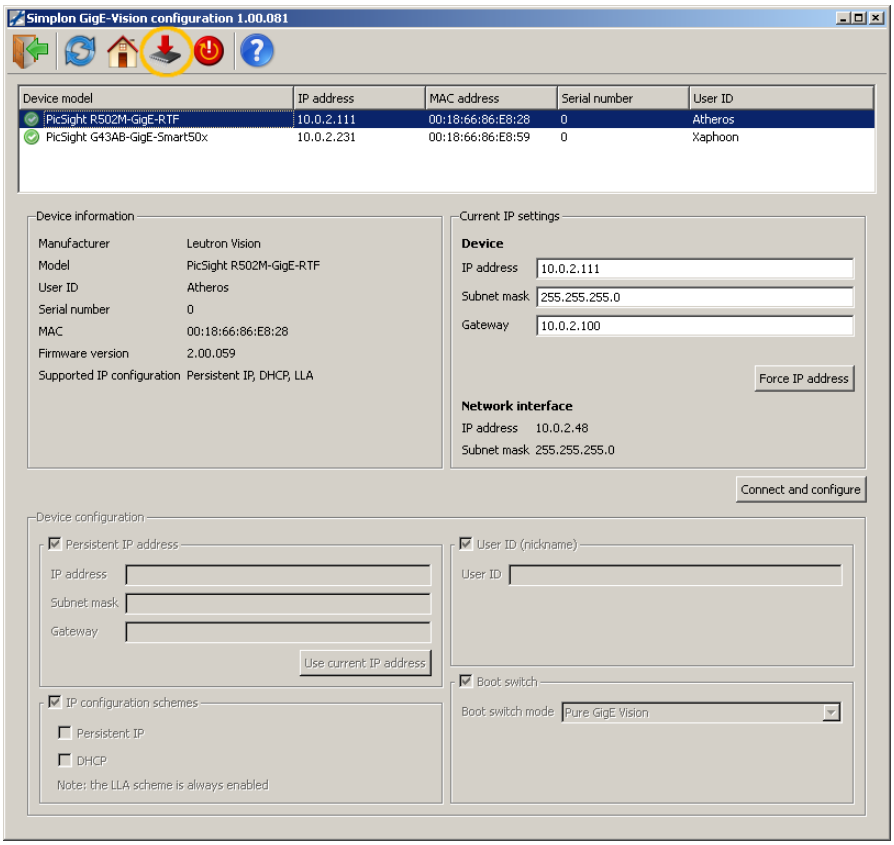
[2] http://www.leutron.com/support-downloads/download-area/

It also assumes that the camera to be upgraded is already based on firmware of the 2.x line. When upgrading from the 1.x firmware version, please read additional instructions in Section 5.4.1, “Upgrading from the legacy firmware line (1.x)” [p. 88].

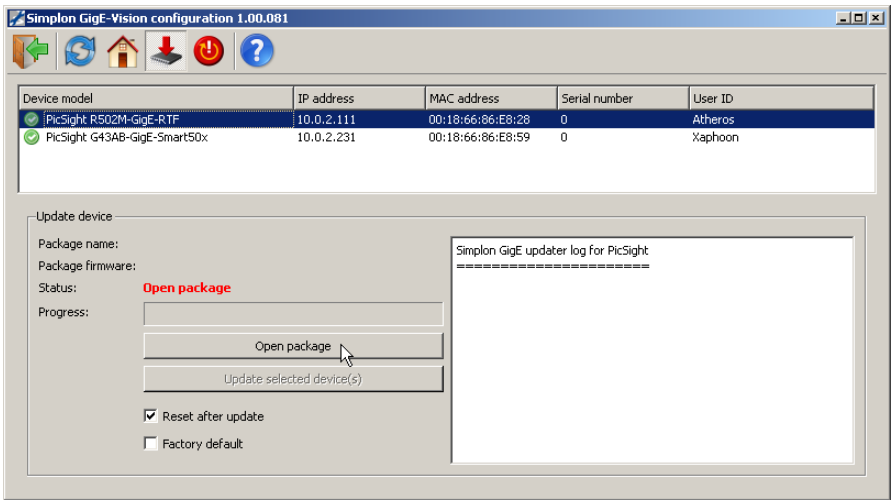
*The firmware update procedure is vendor specific, the Simplon GigE Vision Configuration Tool will update only the PicSight-GigE/PicSight-Smart cameras. Do not try to use it to update firmware on a 3rd party GigE Vision camera.*

Now the update procedure itself (note that the exact look of the Simplon GigE Vision Configuration Tool might slightly vary among individual Simplon versions):

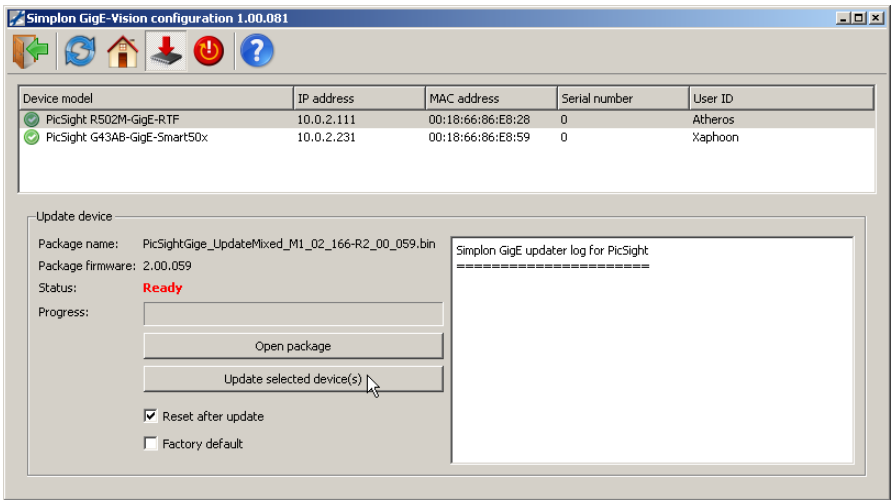
1. Start Simplon GigE Vision Configuration Tool. It will display the list of discovered GigE Vision cameras. Note that it might display also foreign GigE Vision cameras if they are present in the network — but the firmware update can be naturally applied only to the PicSight-GigE cameras. Click the Firmware update button to switch to the update mode. Then select the camera(s) to be updated, multiple cameras can be selected while holding the **Ctrl** key.



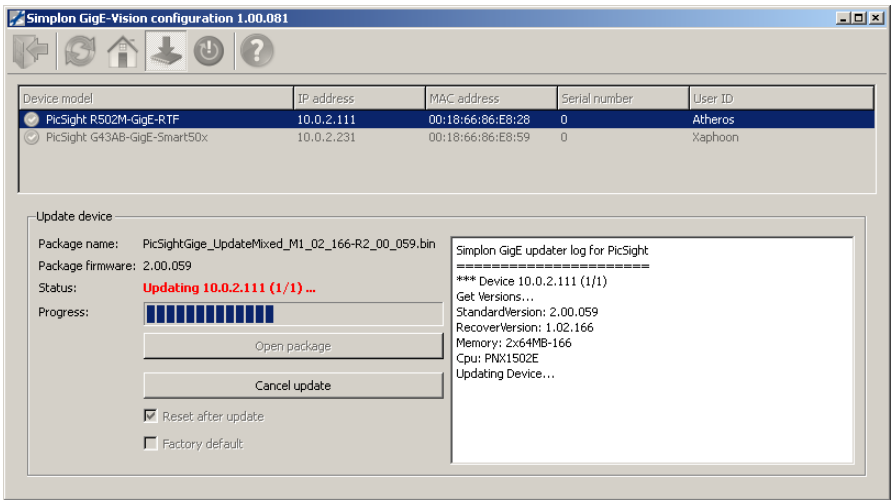

2. Click the Open package button and browse for the firmware package to be applied.



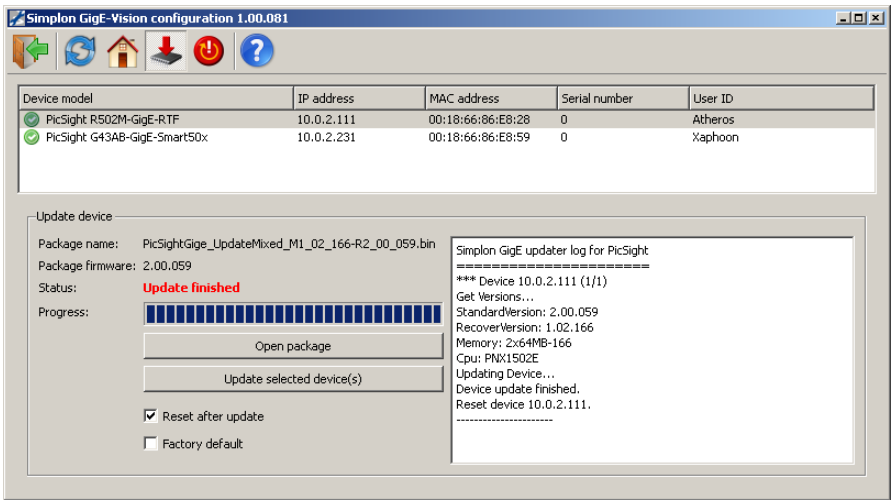

3. When ready, click the Update selected device(s) button to start the update. Note that you might select multiple cameras in the list to upload them all in one step. The check boxes under the button allow to indicate, whether the updated cameras should be immediately reset after the update and if their settings should be switched to factory defaults.




4. The Simplon GigE Vision Configuration Tool will indicate the progress. It will take a while. Do not disconnect or power off the cameras during the update procedure!




5. When finished, click again the Firmware update button in the main toolbar of Simplon GigE Vision Configuration Tool to switch back to its main window. If you did not enable the Reset after update button, remember that the new firmware will not become active until the next camera reboot.




## 5.4.1. Upgrading from the legacy firmware line (1.x)

When upgrading from firmware version 1.x, few more steps need to be done. The steps are described briefly below — whenever in doubts, contact us to obtain further information.

Note that the firmware lines of the 1.x and 2.x lines differ fundamentally. While the 1.x firmware supports the “legacy” operating mode of the PicSight-GigE cameras, compatible with the LV-SDS package, the 2.x firmware is purely GigE Vision compatible. If you need to run the camera in a legacy LV-SDS application, do not upgrade to a 2.x firmware version.

To upgrade the firmware from version 1.x to 2.x:

1. Follow the instructions above to upgrade the camera first to the latest 1.x firmware available in our download area[3]. The minimal required version is 1.02.149. This firmware will be used for recovery purposes (see Section 5.5, “Firmware recovery” [p. 89]). Do not forget to reset the camera.

[3] http://www.leutron.com/support-downloads/download-area/

2. When the newest 1.x firmware is applied, let's start with uploading the 2.x firmware. If the camera is not automatically discovered by the Simplon GigE Vision Configuration Tool after rebooting, click the refresh button to discover it. If the camera is not directly accessible due to its IP configuration after the update (eg. different subnet), adjust the IP configuration accordingly (more details in Section 5.6, “Simplon GigE Vision Configuration Tool” [p. 90]).

3. Repeat the upgrade procedure with the latest available firmware from the 2.x line. Reboot the camera and let the Simplon GigE Vision Configuration Tool tool discover it again. If needed, adjust its IP settings.

4. Click the HTTP settings button in the main toolbar to access the HTTP configuration (Section 5.3, “HTTP-based configuration” [p. 82]). Your web browser will be started, displaying the camera's configuration page. Click the Administration link (username “gige”, password “gige”), then follow the Change system operating mode link. Select the Pure GEV option and click the Save button. Reset the camera again.

5. After discovering the camera again, you can adjust the final desired IP configuration parameters. Depending on your network configuration, you can define, whether the camera will use a persistent IP configuration or if it will obtain it through DHCP/LLA. All details about the IP configuration are discussed in Section 5.6, “Simplon GigE Vision Configuration Tool” [p. 90].

# 5.5. Firmware recovery

For the case the PicSight-GigE camera fails to load successfully due to an error, a recover copy of the system is available in the PicSight-GigE flash memory:

- For cameras based on the firmware version 2.x, the recovery mode loads a legacy firmware of the 1.x line, which is also stored in the camera's flash memory.
- For older cameras containing ony the firmware version 1.x, the recovery mode loads a limited version of the firmware, allowing just to fix the system by re-loading a new firmware.

The recovery mode should be used when the camera repeatedly fails to start properly. Such situation indicates that the camera's installed firmware is corrupted. Note that the camera's boot procedure can be monitored through the status LED (Section 3.9, “Status LED” [p. 48]).

To boot the camera in the recovery mode, press the “Reset/Recovery” button placed on the back plate of the PicSight-GigE camera during camera's boot, i.e. hold down the reset button within 5 seconds right after powering the camera.

*Figure 5.31. Position of the “recovery reset” button on PicSight-GigE-AR and PicSight-GigE-AS models*

When the “Reset/Recovery” button is being pressed during the boot process (i.e. within 5 seconds after power up), the recover system is loaded. The LED light blinks slower than when booting the normal system. You can also check the system on the home page of PicSight-GigE (when accessing

the camera over HTTP, see Section 5.3, “HTTP-based configuration” [p. 82]), which is colored differently and displays additional “*** RECOVER MODE ***” label.

When the camera boots to a recovery mode, remember, that it can use different IP configuration settings than it had originally configured. In particular, the firmware version 1.x starts by default with fixed IP address `192.168.1.55`. You will need to adjust the temporary IP address corresponding with your network settings through Simplon GigE Vision Configuration Tool, or eventually temporarily configure a network card to match the `192.168.1.0` subnet.

When started the recovery mode, you should especially restore the camera's original firmware to fix the broken system. To do this, upload the latest available firmware version to the camera, using instructions from Section 5.4, “Firmware update” [p. 85]. Also the essential configuration can be done through the camera's HTTP interface.

The changes in the configuration, made through the HTTP-based configuration when the recover system is loaded, are made to the normal system, not to the recovery system.

## 5.6. Simplon GigE Vision Configuration Tool

The Simplon GigE Vision Configuration Tool allows to perform several important configuration tasks, including especially the IP related configuration and firmware update. The IP configuration options can be used to configure any GigE Vision compliant camera, the firmware update is, naturally, intended only for the PicSight-GigE/PicSight-Smart models.

When the tools starts, up, it searches the network for connected GigE Vision cameras and displays them in a list.

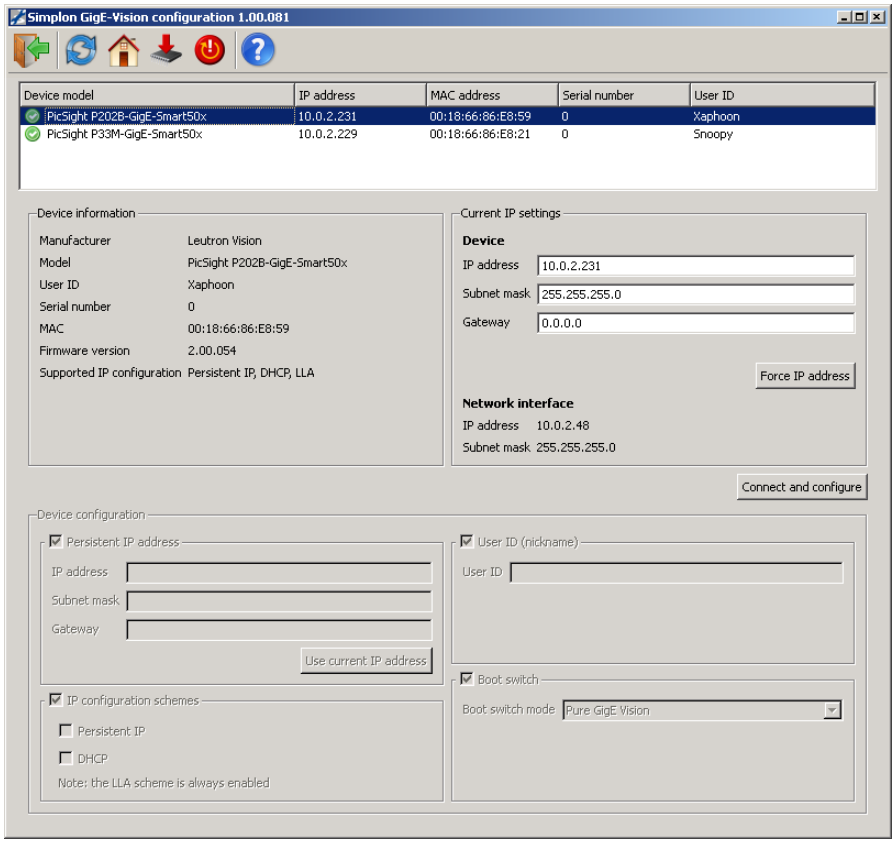



*Figure 5.32. Simplon GigE Vision Configuration Tool*

Each camera is described using its basic properties, such as model name, IP address, serial number or user name. Depending on the camera status, one of the following icons is displayed next to the camera's model name:

The camera is accessible and can be directly configured.

The camera is not currently accessible, although it is on a correct subnet — it is perhaps being used by an other application on the same or other PC.

The camera cannot be directly configured, because it is on a different subnet. You will first need to switch the camera, at least temporarily, to the subnet corresponding with the network interface it is connected to. Note that in this case the application does not have a knowledge, whether the camera is at the moment used by another application.

The tool allows to adjust IP configuration for the selected camera.

For the cameras not marked as inaccessible (i.e. for cameras with green or red icon), the current IP configuration (IP address, subnet mask, default gateway) can be adjusted. Note that such new configuration will be valid only in the current session, but will be lost upon next camera boot. Typical use case is to bring the camera to the subnet compatible with the interface it is connected to, so that it is directly accessible for further configuration. Select the camera, fill in the desired new values and click the Force IP address button. Whenever the adjusted address/subnet will not match the subnet of the network interface the camera is connected to, a warning will be displayed. For cameras that are currently under control of different application (they appear with yellow icon), the attempt to change the configuration will be silently discarded by the camera.

For directly accessible cameras (green icon), the more options can be configured. If the camera is not directly accessible, it's necessary to first bring it to the subnet corresponding with the network interface the camera is connected to, as described above. The configurable options include IP configuration mode (persistent IP, DHCP, LLA), persistent IP configuration parameters (IP address, subnet mask, default gateway) user ID (nickname) and boot switch mode (pure GigE Vision mode or legacy mode). Select the camera and click the Connect and configure button. The tool will gain exclusive access to the camera, read its configuration and allow changing the configuration. Select which property groups should be configured, adjust their values and when finished, click the Apply and disconnect button.

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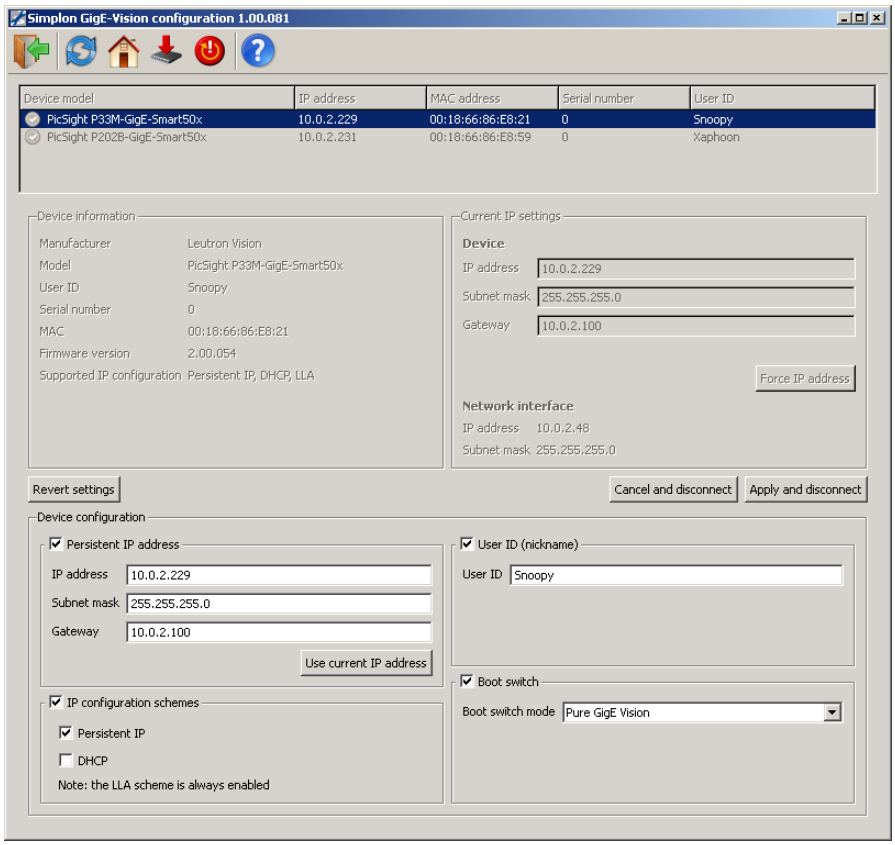


*Figure 5.33. Simplon GigE Vision Configuration Tool, configuration options*

Finally, the tool itself can be configured through the main toolbar, which includes following buttons:

Exits the tool.

Refreshes the list of detected cameras.

Starts your default web browser, connecting to the HTTP interface of the selected camera.

Switches to the firmware update mode and back. Refer to Section 5.4, “Firmware update” [p. 85].

Reboots the selected camera.

Displays help.

## 5.6.1. Discovering the cameras with wrong subnet settings under Linux

Depending on the system configuration, the Simplon GigE Vision Configuration Tool and Simplon in general might not be able to discover cameras that are configured for different subnet than the network card they are connected to. The reason is that some Linux systems use by default so called “reverse path packet filtering” — a mode in which the kernel drops any incoming packets that

do not match the routing table (which is usually the case for discovery responses from cameras on wrong subnets).

The reverse path filter can be disabled through the `sysctl` interface, disable if for each interface used to connect the cameras (`net.ipv4.conf.ethX.rp_filter`) and also globally (`net.ipv4.conf.all.rp_filter`). For example:

```
sudo sysctl net.ipv4.conf.all.rp_filter=0
sudo sysctl net.ipv4.conf.eth0.rp_filter=0
sudo sysctl net.ipv4.conf.eth1.rp_filter=0
```

To make the settings permanent, adjust them directly through `/etc/sysctl.conf`/`/etc/sysctl.d`:

```
# /etc/sysctl.conf
net.ipv4.conf.all.rp_filter=0
net.ipv4.conf.eth0.rp_filter=0
net.ipv4.conf.eth1.rp_filter=0
```

*Please study the `rp_filter` documentation to understand its impact and decide when you want to disable it. Perhaps it could be disabled just for the network interfaces used to connect cameras, but keep enabled for the "public" ones. Note also, that when using the `ip_forward` option, the reverse path filter might be also active implicitly. Study documentation of your system, to know all details.*

*When disabling the reverse path filter does not help to discover the cameras with wrong subnet configuration, please try to run the Simplon GigE Vision Configuration Tool with superuser privileges. In some situations, the Simplon has to rely on special (root-only) socket options during the discovery process — and when running the tool with insufficient rights, the cameras on wrong subnets might not be visible.*

# 5.7. Simplon configuration

Following section provides basic information about Simplon software package configuration. More information about the Simplon configuration, troubleshooting and other related topics can be found in Simplon getting started.

## 5.7.1. Simplon Settings utility and the configuration file

The Simplon configuration options are concentrated in a single file, `lv.simplon.ini`. On Windows systems the file is located in the "application data" part of the installation. On Linux systems it's stored by default in `/etc/opt/simplon`.

The file can be edited directly — every single option is well documented directly in the file, including it's possible values. Note that on Linux superuser privileges are required to edit the file.

Instead of editing the file directly, however, the recommended alternative is to edit the file through a helper utility, Simplon Settings (Windows: menu Start → Programs → Leutron Vision Simplon → Tools → Simplon Settings; Linux: /opt/simplon/bin/lv.settings as superuser). The tool provides a comfortable way to edit the `lv.simplon.ini` file.

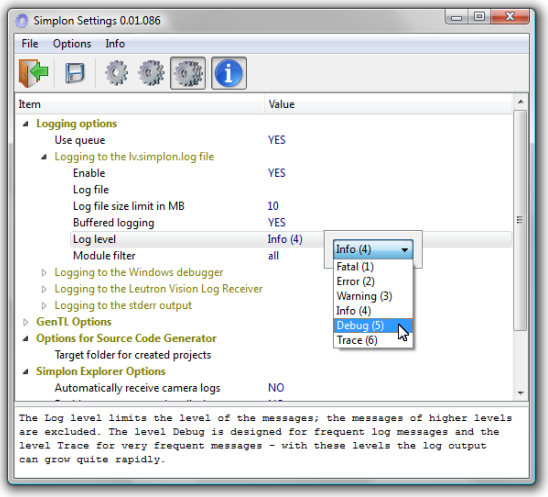


*Figure 5.34. Simplon Settings utility*

The tool's interface can be controlled threw a handful of menu options (or corresponding buttons). You can show/hide the info pane with info about the selected configuration option. You can switch between three configuration levels (beginner, expert, guru) — the higher level, the more detailed options are shown. Finally, you can store the changes.

The set of options itself is ever evolving, so the Simplon Settings tool itself (or the `lv.simplon.ini` file) is the most complete documentation. The options include detailed logging configuration (see also Chapter 9, *Troubleshooting & Support* [p. 288]), system installation related info and configuration of individual Simplon subsystems.

## 5.7.2. Selected configuration options

The documentation for all the Simplon configuration options is provided directly in the Simplon Settings utility and the configuration file. Here we'll mention just few selected important options:

Logging options

The Simplon log is an important tool for any support and troubleshooting. For regular operation, the log might be kept at low level (default is level `Info (4)`) or even switched off to optimize the performance. However, during application development or when debugging a problem, we recommend to switch the `Log level` configuration option to `Trace (6)`. All log files sent to our support team should be created with level `Trace (6)`.

The logging infrastructure is optimized for high performance. For example, the logging to file is buffered to minimize the disk access overhead. This can have a drawback, however, that in case of an application crash, the last part of the log might be missing in the file. When troubleshooting application crashes, we recommend to switch on the option `Disable all buffering` .

Heartbeat timeout

`Heartbeat timeout` is an important parameter, related to GigE Vision cameras only (PicSight-GigE/PicSight-Smart).

This timeout, in milliseconds, defines how frequently has the camera send the “heartbeat” messages to the camera, indicating that it's still alive. When the camera does not receive the message within the specified timeout period, it assumes the application has gone away and disconnects itself. The default value used in Simplon is 3 s.

At most times, the heartbeat handling is fully transparent to the user. However, during debugging, when a developer stops the application at a breakpoint for single stepping, the Simplon heartbeat handling thread would also stop, fail to deliver the heartbeat messages and the camera would disconnect. To prevent that, we recommend to increase the heartbeat timeout parameter to a higher value. The exact value should be a compromise between being able to debug comfortably, while understanding that when the application stops unexpectedly without disconnecting the camera properly, it will take a while before the camera disconnects automatically and becomes available for another connection.

The parameter is configurable through camera features at runtime, while its default value can be adjusted through the Simplon Settings utility.

## 5.8. Acquisition and runtime configuration

The camera runtime functionality is fully configurable through the GenICam interface. The individual features, their relationships and use is described in chapter Chapter 6, *Camera features and their control* [p. 96].

Accessing the camera (feature control and image acquisition) using the Leutron Vision Simplon API interface is documented in Simplon API documentation: Simplon programmer's guide.

Accessing the camera (feature control and image acquisition) using 3rd party software packages compatible with GenICam GenTL and GigE Vision standards is documented in chapter Chapter 8, *Connecting with 3rd party software packages* [p. 269].

# 6. Camera features and their control

## 6.1. Common principles

The camera features are controlled through GenICam based feature tree. For clarity, we will present them below in sections corresponding to individual categories in the feature tree. For individual features, we'll provide a sample code showing how to access given feature through the Simplon API and “pseudo-code” demonstrating how to use the feature in a generic GenICam based application. Naming and grouping the features strictly follows the GenICam SFNC standard. The Simplon API samples are provided in plain C, other variants can be easily generated by the Simplon Source Code Generator (refer to Simplon programmer's guide).

The code examples are marked with corresponding icons:

Introduces sample code demonstrating usage of the discussed features through the Simplon API interface. The code snippets are using directly the “native” Simplon API functions and constants. They are presented in the plain C variant, but users programming in other languages should find all needed info in them easily. Whenever a “shortcut” function exists for given functionality in Simplon API, it is presented.

Pseudocode demonstrating usage of the discussed features through a generic GenICam interface. These code snippets are intended for users accessing the cameras through other software interface than Simplon API. It uses the actual GenICam names of the individual features, rather than Simplon API constants. The “pseudo function calls” need to be replaced with actual function names used in the actually used software package.

The sections below document all the features available within the camera family. Some of the features, are, however, only available on certain camera models. Some features might also not be available on older firmware versions. Simplon API provides means to check if a given feature is supported by the connected camera.

Simplon API can add additional “capabilities” to the connected cameras. For example, it can supplement image processing capabilities (such as LUTs or color transformation) by means of software if given camera does not implement them. Simplon API also provides additional extras on top of the processing primitives offered by a camera — examples are white balance coefficients calculations, brightness/contrast adjustments through LUT etc. Details are discussed in Simplon programmer's guide.

The camera feature tree control is based on principles introduced in the GenICam standard. It might be useful to get familiar with these principles in corresponding section in Simplon getting started maual.

The camera feature model follows the GenICam SFNC (Standard Features Naming Convention) standard as closely as possible. Only for functionality that cannot be expressed by means of SFNC, then custom feature names are introduced — these have always the “Lv” prefix.

Individual features might be referred through three types of identifiers in the manual (overview of all the features is given in Section 6.17, “Feature summary” [p. 203]):

- GUI name (display name), eg. *Exposure time* — this is the human readable name of the feature, used to display the feature in a graphical user interface, such as in Simplon Explorer. When referring to the features in a free text, we usually use the GUI name, unless using the GenICam name is needed for clarity. The name is rendered in a cursive font.
- GenICam name, eg. `ExposureTime` — the actual name of the feature used to identify it in GenICam infrastructure. This name is important for users connecting to the cameras from 3rd

party software packages, other than Simplon API. We use it in all GenICam pseudo-code examples. In free text they are rendered in a monospace font.
- Simplon API constant, eg. `LvDevice_ExposureTime` — the identifier used to refer to the feature in Simplon API. Used in all Simplon API code examples. In free text they are rendered in a monospace font.

# 6.2. Camera classes

The individual Leutron Vision camera families contain several “classes” of camera models, providing different level of functionality. The individual classes are available for every supported sensor type.

## 6.2.1. Basic PicSight-GigE models

Most of the features and interfaces are available for all the camera classes. The “basic” PicSight-GigE models are thus full featured industrial cameras without any limitations. The advanced camera classes described below extend the camera functionality by specific additional options.

## 6.2.2. RTF cameras

The PicSight-GigE cameras can be delivered with the RTF (Real-Time Function) option, which adds several advanced features to the camera functionality. The add-on features include:

- High quality Bayer decoder on camera
- RGB color transformation matrix, LUTs, white balance
- Integrated lens controller
- Analog video output

Contact our sales team to find out the full list of the RTF options supported by your preferred camera model.

## 6.2.3. Smart cameras

Every PicSight-GigE camera also exists in the “smart” version, PicSight-Smart. The basic functionality and Ethernet interface of the PicSight-Smart cameras is identical to PicSight-GigE cameras, but PicSight-Smart models furthermore provide additional resources and functionality:

- 32-bit RISC processor
- additional RAM memory (64 MB or more), flash memory
- real-time operating system
- SDK including C/C++ compiler and libraries for image acquisition, camera control, communication facilities and more

This allows to perform conditioning of the acquired image or full image processing on the camera. Results of the processing can be signalled to the outside world through the i/o lines, over the serial RS-232 line or over the Ethernet interface.

The PicSight-Smart cameras also provide a set of generic features in the camera feature interface. These features can be used for purposes defined by the “smart” application. Overview of these features is given in Section 6.16, “Smart application control” [p. 200]. The PicSight-Smart cameras also offer additional functionality, such as extended I/O interface, RS232 communication port, and more. Contact our sales team to learn the full list.

Technical details about individual PicSight-Smart cameras are listed in Appendix B, *Technical specifications for the “smart” models* [p. 332].

Complete description of the PicSight-Smart cameras and especially their programming and configuration is described in dedicated documents: PicSight-Smart Library API programmer's guide, PicSight-Smart Library API reference.

*In case of the PicSight-Smart cameras, the features discussed throughout this chapter can be also configured directly by the "smart" application itself. The principles behind the features are the same, no matter if accessed from the host or smart application. To see the code examples for the PicSight-Smart Library API, check the corresponding chapter in PicSight-Smart Library API programmer's guide.*

### 6.2.4. OEM features

Additional features and options are available for OEM customers, new features might be added on request. Please contact us to discuss your particular needs.

## 6.3. Information about the camera

Most of the features in this category provide read-only information about the camera. Only few of them can be writable as well.

*Figure 6.1. Example GUI showing the device information features*

### 6.3.1. Device identity and version

The basic information about the camera includes:

*Vendor Name* — Name of the camera's vendor (manufacturer). For all Leutron Vision camera types, this feature reads `Leutron Vision`.

*Model Name* — Name of the camera model. The name includes information about the camera family, sensor type, interface and possibly other variations. Refer to Section 2.2, "PicSight model naming convention" [p. 23].

*Manufacturer Info* — Manufacturer information about the camera. This field is usually empty.

*Device Firmware Version* — Version of the camera firmware as a string. The version is encoded as `M.mm.sss`, where `M` stands for major, `mm` for minor and `sss` for subminor version. For example `2.00.005`.

*Recovery Firmware Version* — Firmware version into which the camera would be recovered. Besides the actual firmware, the camera carries also an older firmware version into which it can be recovered in case of serious problems, see Section 5.5, "Firmware recovery" [p. 89].

*Device Hardware Version* — String holding various information about the camera hardware version. On some cameras it might be empty. The contents is intended for our support team.

| | |
|---|---|
| *Device ID* (serial number) | String representation of camera's unique serial number.<br><br>*Beware, the Simplon API identifier for this feature is `LvDevice_DeviceSerialNumber` to distinguish it from the GenICam GenTL "device ID" used for device enumeration.* |
| *Device User ID* (nickname) | Writable string, which can be used to assign a unique camera "nickname" by the user. The nickname can be up to 15 characters long and it is one of the options how to find/identify a camera in Simplon API. |
| *Device Scan Type* | Scanning type of a camera. This SFNC (Standard Features Naming Convention) feature is intended for generic applications — it returns *Area Scan* for all Leutron Vision cameras. |
| *Device Type* | String representation of camera type/class. The type associates the camera with a given level of functionality (independent on the mounted sensor). Example values are `GigE`, `GigE-RTF`, or `Smart`, see Section 6.2, "Camera classes" [p. 97]. |

Simplon

```
LvHDevice hDev; // open the device to get the handle
// read basic information
char StringVal[1024];
LvGetString (hDev, LvDevice_DeviceVendorName, StringVal, 1024);
LvGetString (hDev, LvDevice_DeviceModelName, StringVal, 1024);
LvGetString (hDev, LvDevice_DeviceManufacturerInfo, StringVal, 1024);
LvGetString (hDev, LvDevice_DeviceFirmwareVersion, StringVal, 1024);
LvGetString (hDev, LvDevice_LvRecoveryFirmwareVersion, StringVal, 1024);
LvGetString (hDev, LvDevice_DeviceVersion, StringVal, 1024);
LvGetString (hDev, LvDevice_DeviceSerialNumber, StringVal, 1024);
LvGetString (hDev, LvDevice_DeviceUserID, StringVal, 1024);
LvGetString (hDev, LvDevice_LvDeviceType, StringVal, 1024);
// set new nickname (user ID)
LvSetString (hDev, LvDevice_DeviceUserID, "FoobarCamera");
// check the scanning type (always LvDeviceScanType_Areascan)
int32_t EnumVal;
LvGetEnum (hDev, LvDevice_DeviceScanType, &EnumVal);
```

GENICAM

```
// read basic information
read_string (DeviceVendorName)
read_string (DeviceModelName)
read_string (DeviceManufacturerInfo)
read_string (DeviceFirmwareVersion)
read_string (LvRecoveryFirmwareVersion)
read_string (DeviceVersion)
read_string (DeviceID)
read_string (DeviceUserID)
read_string (LvDeviceType)
// set new nickname (user ID)
write_string (DeviceUserID, "FoobarCamera")
// check the scanning type (always AreaScan)
read_enum (DeviceScanType)
```

## 6.3.2. Runtime information

Apart of the basic information, the camera also provides various “runtime” status information:

*Temperature* The camera self-diagnostics includes temperature measurement at various locations. Currently reported measurements include temperature at the sensor board and at the main board. Note that before reading the actual value, it is necessary to first adjust the *Temperature Selector* to correct measurement point.

*Up Time* Current up-time of the device (time period elapsed since camera boot), as integer value in milliseconds.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// read sensor temperature
LvSetEnum (hDev, LvDevice_DeviceTemperatureSelector,
                 LvDeviceTemperatureSelector_Sensor);
double FloatVal;
LvGetFloat (hDev, LvDevice_DeviceTemperature, &FloatVal);
// read main board temperature
LvSetEnum (hDev, LvDevice_DeviceTemperatureSelector,
                 LvDeviceTemperatureSelector_Mainboard);
LvGetFloat (hDev, LvDevice_DeviceTemperature, &FloatVal);
// read device uptime
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_LvDeviceUpTime, &IntVal);
```

GEN<i>CAM

```
// read sensor temperature
write_enum (DeviceTemperatureSelector, Sensor)
read_float (DeviceTemperature)
// read main board temperature
write_enum (DeviceTemperatureSelector, Mainboard)
read_float (DeviceTemperature)
// read device uptime
read_int (LvDeviceUpTime)
```

## 6.3.3. Resetting the camera

It is possible to reset (reboot) the camera using the *Reset Device* command. It is important to remember, that after issuing the command, the connection with the camera is lost immediately and it needs to be re-opened after it is booted again. Any temporary camera settings will be lost, the camera will start in the default settings (note that the default startup settings of the camera are user-configurable, see Section 6.13, “User sets (saving/loading camera configuration)” [p. 179]). The camera also performs complete initialization procedure, such as eg. IP configuration (when using DHCP, it can boot with different IP address).

Simplon

```
LvHDevice hDev; // open the device to get the handle
// reset the camera
LvCmdExecute (hDev, LvDevice_DeviceReset);
```

GENICAM

```
// reset the camera
exec_cmd (DeviceReset)
```

## 6.3.4. Pixel clock (sensor digitization clock)

Pixel clock feature is a bit special since while it's typically a read-only informative feature, on certain camera models and firmware versions, it might be configurable (section Section 6.6, “Acquisition and trigger control” [p. 124] discusses other options to configure acquisition frame rate). To access the pixel clock frequency through the *Clock Frequency* floating point feature, it's first necessary to set *Clock Selector* to *Sensor Digitization* to differentiate from other clocks a camera might be reporting.

Simplon

```
LvHDevice hDev; // open the device to get the handle
//read camera sensor digitization clock in Hz
LvSetEnum (hDev, LvDevice_DeviceClockSelector,
                 LvDevicClockSelector_SensorDigitization);
LvGetFloat (hDev, LvDevice_DeviceClockFrequency, &FloatVal);
// set pixel clock if the camera supports it (float in Hz)
LvSetEnum (hDev, LvDevice_DeviceClockSelector,
                 LvDevicClockSelector_SensorDigitization);
LvSetFloat (hDev, LvDevice_DeviceClockFrequency, 28.6*1000000);
```

GENICAM

```
// read camera sensor digitization clock in Hz
write_enum (DeviceClockSelector, SensorDigitization)
read_float (DeviceClockFrequency)
// set pixel clock if the camera supports it (float in Hz)
write_enum (DeviceClockSelector, SensorDigitization)
write_float (DeviceClockFrequency, 28.6*1000000)
```

## 6.3.5. Register streaming support

The camera supports so called “register streaming”. This GenICam term refers to safe storing and re-loading entire camera configuration. Safe means that it restores complete “state” of the camera, without need to know about complex feature dependencies. The same settings can be applied to multiple cameras of the same type and version. To work reliably, the operation must exactly follow rules standardized by the GenICam standard.

When using the Simplon API, the camera settings might be stored and re-loaded using functions `LvCameraSaveSettings()` and `LvCameraLoadSettings()`, so the user need's not care about the internal meachanism.

Other GenICam based software packages will usually also provide convenience functions to handle camera settings. The camera features controlling the standardized register streaming operation are: `DeviceRegistersStreamingStart`, `DeviceRegistersStreamingEnd`, `DeviceRegistersCheck` and `DeviceRegistersValid`.

Note that the camera itself is also able to remember its current state and restore it later upon user request or during boot, see Section 6.13, “User sets (saving/loading camera configuration)” [p. 179].

# 6.4. Transport layer control

The most important feature in this category is *Payload Size*, which is used to determine the size of the image data during buffer allocation. Besides that, the category contains lot of “transport layer” (GigE Vision) related features, most of which are handled internally by Simplon API or other imaging library, or can be configured comfortably through Simplon GigE Vision Configuration Tool.

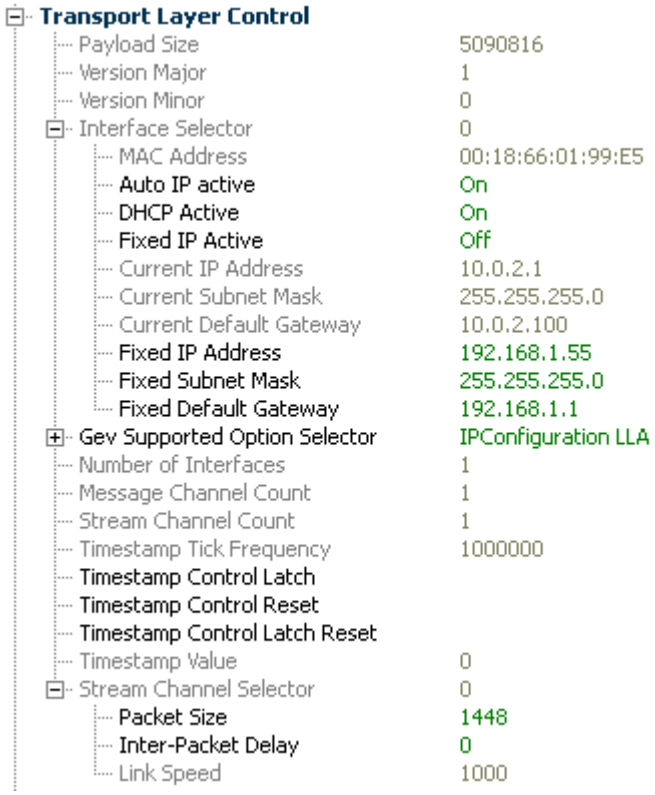


*Figure 6.2. Example GUI showing the transport layer control features*

## 6.4.1. Acquired image data size

When preparing for acquisition, the application needs to know the required size of the buffers to be allocated for receiving the acquired data. The size depends on various options, such as image size and pixel format (Section 6.5, “Image format” [p. 107]) or presence of chunk data in the image (Section 6.11, “Chunk data” [p. 168]).

The camera reports the image data size corresponding with current configuration in the *Payload Size* feature, which provides the data size in bytes.

The camera allows to switch to a mode when some of the parameters (eg. image size) affecting the payload size can change freely during acquisition. In such mode the *Payload Size* feature always reports the maximal possible size, so that this size can always be safely used for buffer allocation.

It is important, that the actual value of the *Payload Size* feature does not change during active acquisition — otherwise the application is in danger that its buffers will not be large enough for the received data. GenICam provides a standard way to “lock” the essential “transport layer” features during acquisition through feature called `TLParamsLocked`. Note that this feature is set transparently during acquisition by Simplon API — and in all reasonable GenICam based software packages, so the user does not need to care about it.

*Simplon API offers additional image processing functions that can also alter the image data size — and thus the required size of the target buffer. This topic is, however, behind the scope of this manual, it is discussed in Simplon programmer's guide.*

Simplon

```
LvHDevice hDev; // open the device to get the handle
// read the "payload size"
// (buffer size required to hold acquired image data)
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_PayloadSize, &IntVal);
// now allocate the buffers and use them for the acquisition
```

GEN<i>CAM

```
// read the "payload size"
// (buffer size required to hold acquired image data)
read_int (PayloadSize)
// now allocate the buffers and use them for the acquisition
```

## 6.4.2. Selected GigE Vision related features

All essential camera registers dictated by the GigE Vision standard (so called “bootstrap registers”) are exposed to the user through the feature tree interface. However, most of these features will be configured “under the hood” by Simplon (or other GigE Vision compatible software controlling the camera) and the user should not even try to touch them without very good reason. These features become visible only at the “guru” feature visibility level.

Some of these features, are, however, useful for regular use — and these are listed below:

*MAC Address*

The *MAC Address* feature is natively an unsigned 64-bit integer. Simplon API, however, allows to read it also in form of string with colon-separated hexadecimal representation of individual bytes (such as `00:18:66:01:97:5A`).

Current IP settings

Current IP settings include *Current IP Address*, *Current Subnet Mask* and *Current Default Gateway*. The features are natively unsigned 32-bit integers, but Simplon API also allows reading them in the usual string representation, ie. dot separated, decimal (such as `10.0.2.3`).

The current IP settings of the camera can be forced to arbitrarily chosen values using Simplon GigE Vision Configuration Tool (see Section 5.6, “Simplon GigE Vision Configuration Tool” [p. 90]).

Persistent IP settings

Persistent IP settings specify the IP settings (features *Persistent IP Address*, *Persistent Subnet Mask* and *Persistent Default Gateway*) that the camera will use upon booting, when its IP configuration is switched to “Persistent IP” (in contrast to DHCP or LLA). The features are natively unsigned 32-bit integers, but Simplon API also allows reading and writing them in the usual string representation, ie. dot separated, decimal (such as `10.0.2.3`). These settings are stored in camera's non-volatile memory, so that the camera “remembers” them after power-off cycle.

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The persistent IP settings of the camera can be also comfortably configured using Simplon GigE Vision Configuration Tool (see Section 5.6, “Simplon GigE Vision Configuration Tool” [p. 90]).

IP configuration scheme

The IP configuration scheme to be used by the camera during boot-up can be adjusted by swtiching individual protocols on an off (see code samples below). The available protocols are:

- **Persistent IP.** The camera uses the IP settings configured through corresponding features (see above) or the Simplon GigE Vision Configuration Tool. Controlled through boolean flag *Persistent IP Active*.

  **DHCP.** Camera attempts to obtain the IP settings from a DHCP server, if available on the network, using the DHCP protocol. Controlled through boolean flag *DHCP Active*.

  **LLA.** The LLA (Link-Local Address) protocol can be used for IP settings configuration if the camera is connected directly to the network card, not through a local network. Note that just a single LLA configured camera might be connected to the computer at a time. Controlled through boolean flag *LLA Active*.

According to the GigE Vision standard, if multiple protocols are enabled, the order of selecting them is as follows:

1. Persistent IP — if enabled

2. DHCP — if enabled

3. LLA

The cameras might be delivered with two different default factory settings:

- DHCP/LLA mode — as required by GigE Vision standard
- Persistent IP mode, set to `192.168.55.1/255.255.255.0` — legacy mode

The IP configuration scheme of the camera can be also comfortably configured using Simplon GigE Vision Configuration Tool (see Section 5.6, “Simplon GigE Vision Configuration Tool” [p. 90]).

*Packet Size*

The *Packet Size* feature controls the size of UDP packets (in bytes) carrying the image data. This value can have significant impact on image acquisition performance (see Section 5.2, “Network performance” [p. 72]). The bigger the packet size, the less overhead is used to transmit and process the packets. However, the standard network equipment can only process packets up to 1500 bytes. To use larger packets, you must be sure that all the network components in the path are capable and configured to recognize larger packets.

The Simplon API can (through Simplon GenTL Producer) execute an autodetection procedure that determines the maximum packet size that can be safely used for the camera, given the actual network configuration.

*Inter-Packet Delay*

The *Inter-Packet Delay* is a delay the camera inserts between every two consecutive packets in the image stream. It is an integer value representing the delay as number of the camera

timestamp ticks, default value is `0`. The camera timestamp frequency is 1MHz, ie. the ticks correspond with time unit of 1 µs. It can be used as a flow control mechanism, to control the maximal data rate coming from the camera — eg. when data coming from multiple cameras connected over a switch would exceed the link bandwidth (see Section 5.2, "Network performance" [p. 72]).

Message channel retransmissions

The camera can attempt to re-send the event messages which got lost (the camera did not receive acknowledge for them). The functionality is controlled by two features, one specifying the retry count (*Message Channel Retry Count*, number of attempts to re-send the same message), the other specifying the transmission timeout (*Message Channel Transmission Timeout*, timeout between two re-send attempts), in milliseconds. The default value for both is `0`. The zero transmission timeout means that the camera will not require any acknowledge for the message packets at all — which means that whenever using a non-zero retry count, the transmission timeout should also be non-zero.

*Heartbeat Timeout*, *Heartbeat Disable*

As dictated by the GigE Vision standard, the Simplon API (same as any other GigE Vision compatible library or application) maintains connection with the camera by means of sending regular heartbeat messages. If the camera does not receive the heartbeat within the period specified in the *Heartbeat Timeout* feature (in ms), it closes the connection with the application.

This has the advantage that if an application crashes, the camera does not remain blocked, listening to non-existing application. It closes the connection and becomes ready to get connected to another application.

In most cases, the user does not need to care about the timeout at all, since it is handled transparently by Simplon API. Only in situations, such as application debugging, when stopping the application in the debugger would also stop the heartbeat message delivery thread, it might be desirable to **temporarily** increase the timeout to prevent loosing connection with the camera.

On cameras with newer firmware versions supporting GigE Vision 1.2 the heartbeat can be temporarily fully disabled using the boolean feature *Heartbeat Disable*. In such case, the camera stops monitoring the heartbeat messages and never closes the connection automatically. Note however, that increasing or disabling the heartbeat timeout can lead to problems when crashing or faulty application fails to close connection with the camera properly.

When changing the *Heartbeat Timeout* value on the camera, the Simplon GenTL Producer intercepts such changes and adapts itself to adjust the frequency of the heartbeat messages accordingly. When using other GigE Vision compatible software, verify, if it handles the heartbeat transparently as well, or if it needs to be notified somehow about the new settings.

Timestamp control

The camera maintains a timestamp counter (64-bit unsigned integer value), which can be read (latched) or reset at any time.

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The camera timestamp frequency is 1MHz, ie. the ticks correspond with time unit of 1 µs. The timestamp is used to label various data provided by the camera, such as image buffers or asynchronous events.

The features controlling the timestamp include *Timestamp Tick Frequency* (in Hz, for our cameras always 1000.000 Hz), *Timestamp Value* (number of ticks since last reset or wrap-around, for our cameras the ticks correspond with micro-seconds), *Timestamp Latch* (command latching the timestamp value, ie. updating the *Timestamp Value* with current status) and *Timestamp Reset* (command resetting the timestamp).

Refer also to the sections about additional "chunk data in the image", including image timestamp (Section 6.11, "Chunk data" [p. 168]), asynchronous events (Section 6.12, "Asynchronous events" [p. 173]) and about "special trigger" functionality allowing to reset timestamp and other counters using an external signal (Section 6.15, "Special features" [p. 196]).

Simplon

```
LvHDevice hDev; // open the device to get the handle
// read the camera MAC address as string or integer
char StringVal[1024];
LvGetString (hDev, LvDevice_GevMACAddress, StringVal, 1024);
int64_t Int64Val;
LvGetInt64 (hDev, LvDevice_GevMACAddress, &Int64Val);
// read current IP settings as strings or integers
LvGetString (hDeve, LvDevice_GevCurrentIPAddress, StringVal, 1024);
LvGetString (hDev, LvDevice_GevCurrentSubnetMask, StringVal, 1024);
LvGetString (hDev, LvDevice_GevCurrentDefaultGateway, StringVal, 1024);
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_GevCurrentIPAddress, &IntVal);
LvGetInt32 (hDev, LvDevice_GevCurrentSubnetMask, &IntVal);
LvGetInt32 (hDev, LvDevice_GevCurrentDefaultGateway, &IntVal);
// configure persistent IP settings as strings or integers
LvSetInt32 (hDev, LvDevice_GevPersistentIPAddress, 0x0A000203);
LvSetInt32 (hDev, LvDevice_GevPersistentSubnetMask, 0xFFFFFF00);
LvSetInt32 (hDev, LvDevice_GevPersistentDefaultGateway, 0x0A000201);
LvSetString (hDev, LvDevice_GevPersistentIPAddress, "10.0.2.3");
LvSetString (hDev, LvDevice_GevPersistentSubnetMask, "255.255.255.0");
LvSetString (hDev, LvDevice_GevPersistentDefaultGateway, "10.0.2.1");
//  adjust IP configuration
LvSetBool (hDev, LvDevice_GevCurrentIPConfigurationLLA, 0);
LvSetBool (hDev, LvDevice_GevCurrentIPConfigurationDHCP, 0);
LvSetBool (hDev, LvDevice_GevCurrentIPConfigurationPersistentIP, 1);
// set packet size
LvSetInt32 (hDev, LvDevice_GevSCPSPacketSize, 9000);
// set inter-packet delay (as number of timestamp ticks)
LvSetInt32 (hDev, LvDevice_GevSCPD, 100);
// adjust message channel retransmission parameters
LvSetInt32 (hDev, LvDevice_GevMCRC, 3);
LvSetInt32 (hDev, LvDevice_GevMCTT, 10); // ms
// configure or disable the heartbeat timeout
LvSetInt32 (hDev, LvDevice_GevHeartbeatTimeout, 10000); // ms
LvSetBool (hDev, LvDevice_GevGVCPHeartbeatDisable, 1);
```

```
// read current timestamp value
LvCmdExecute (hDev, GevTimestampControlLatch);
LvGetInt64 (hDev, GevTimestampValue, &Int64Val);
// reset the timestamp value
LvCmdExecute(hDev, LvDevice_GevTimestampControlReset);
// read the actual timestamp frequency in Hz
LvGetInt32 (hDev, LvDevice_GevTimestampTickFrequency, &IntVal);
```

GEN<i>CAM

```
// read the camera MAC address (64-bit integer)
read_int (GevMACAddress)
// read current IP settings (integer values)
read_int (GevCurrentIPAddress)
read_int (GevCurrentSubnetMask)
read_int (GevCurrentDefaultGateway)
// configure persistent IP (integer values)
write_int (GevPersistentIPAddress, 0x0A000203) //  10.0.2.3
write_int (GevPersistentIPAddress, 0xFFFFFF00) // 255.255.255.0
write_int (GevPersistentIPAddress, 0x0A000201) // 10.0.2.3
//  adjust IP configuration
write_bool (GevCurrentIPConfigurationLLA, false) // disables LLA
write_bool (GevCurrentIPConfigurationDHCP, false) // disables DHCP
write_bool (GevCurrentIPConfigurationPersistentIP, true) // enables fixed IP
// set packet size
write_int (GevSCPSPacketSize, 9000)
// set inter-packet delay (as number of timestamp ticks)
write_int (GevSCPD, 100)
// adjust message channel retransmission parameters
write_int (GevMCRC, 3)
write_int (GevMCTT, 10) // ms
// configure or disable the heartbeat timeout
write_int (GevHeartbeatTimeout, 10000) // ms
write_bool (GevGVCPHeartbeatDisable, true)
// read (latch) current timestamp value (64-bit integer)
exec_cmd (GevTimestampControlLatch)
read_int (GevTimestampValue)
// reset the timestamp value
exec_cmd (GevTimestampControlReset)
// read the actual timestamp frequency in Hz
read_int (GevTimestampTickFrequency)
```

## 6.5. Image format

The image format features allows to configure image size and all related features, as well as the pixel format.

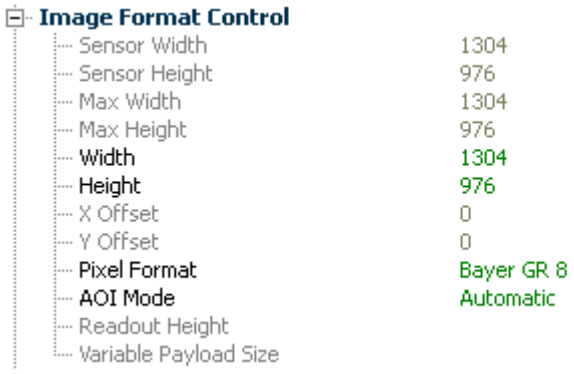


*Figure 6.3. Example GUI showing the image format features*

## 6.5.1. Pixel format

The *Pixel Format* feature controls the nature and layout of pixel data in the image buffer. The set of available pixel formats is strongly dependent on the camera model, in particular on the mounted sensor and also on the image preprocessing functions implemented by given camera, such as Bayer decoding. Generic applications not designed for a single particular camera type should take this into account and query first the available pixel formats.

Simplon API recognizes all the pixel format types and offers functions to process, convert or display them.

The pixel formats fall into following main groups:

- **Monochrome.** The camera provides true monochrome image (luminance only). Depending on the pixel depth, ie. number of bits representing each pixel, the monochrome formats can be `Mono8`, `Mono10` or `Mono12`.

  **Bayer encoded color.** The camera provides color image as raw Bayer mosaic encoded data. Similarly as for monochrome formats, it the Bayer formats also exist in various bit depths. Furthermore, individual image sensors might layout the color components different way within the image — depending on the two pixels in top-left image corner, the formats are named:
  - RG — the top left pixel is red
  - BG — the top left pixel is blue
  - GR — the top left pixel is green, followed by a red one
  - GB — the top left pixel is green, followed by a blue one

  The most usual Bayer encoded formats are `BayerRG8`, `BayerRG12` and `BayerRG10`. Simplon API provides functions for converting Bayer encoded data to true RGB image.

  **True color.** The camera provides “true” color image in 32-bit BGR format (blue component first), 8-bits per color channel. Name of the format is `BGRA8Packed`.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// set pixel format "Mono8", if available
if (LvIsAvailableEnumEntry(hDev, LvDevice_PixelFormat,
                                 LvPixelFormat_Mono))
{
    LvSetEnum (hDev, LvDevice_PixelFormat, LvPixelFormat_Mono8);
}
```

GEN<i>CAM

```
// set pixel format "Mono8"
write_enum (PixelFormat, Mono8)
```

## 6.5.2. Binning and decimation

Binning and decimation are two different sub-sampling operations performed directly at the camera sensor, before image readout. They reduce the horizontal and/or vertical resolution by given factor, thus yielding higher frame rate while preserving the field of view. Compare that with area of interest (AOI) settings, which reduce field of view.

Different factors might be used for horizontal and vertical sub-sampling (yielding a distorted image). Note that the availability and range of possible sub-sampling factors varies among individual camera models. Some color sensors are not capable of binning/decimation even if their monochrome counterparts are.

Let's have a look, how binning and decimation is implemented:

Binning — Every N neighbouring pixels (N being the binning factor) are merged together to produce a single output pixel. Depending on the binning implementation on each respective sensor, the pixels might be merged by summing or averaging pixel values. Binning is applied on the analog pixel values, before digitization. It thus improves low-light camera performance, in particular the signal to noise (S/N) ratio. It is controlled through features *Horizontal Binning* and *Vertical Binning*.

Decimation — Simple pixel skipping, only every Nth (N being the decimation factor) pixel is output from the sensor, the others are ignored. Decimation does not affect lightness or S/N ratio. It is controlled through features *Horizontal Decimation* and *Vertical Decimation*.

The following two figures illustrate the differences between binning and decimation, first using a simple schematics, second on a “real life” image. Note that the actual binning result (in particular the resulting image lightness) might differ depending on the binning implementation on different camera sensors.

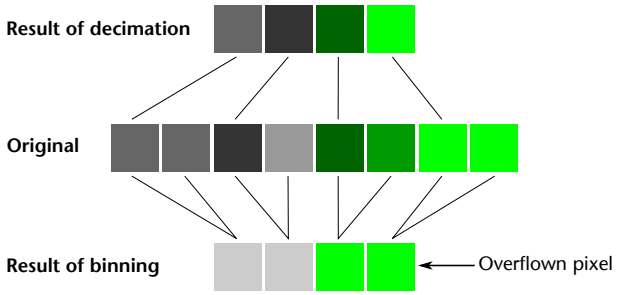


*Figure 6.4. Binning and decimation explained (assumes binning by pixel summing)*

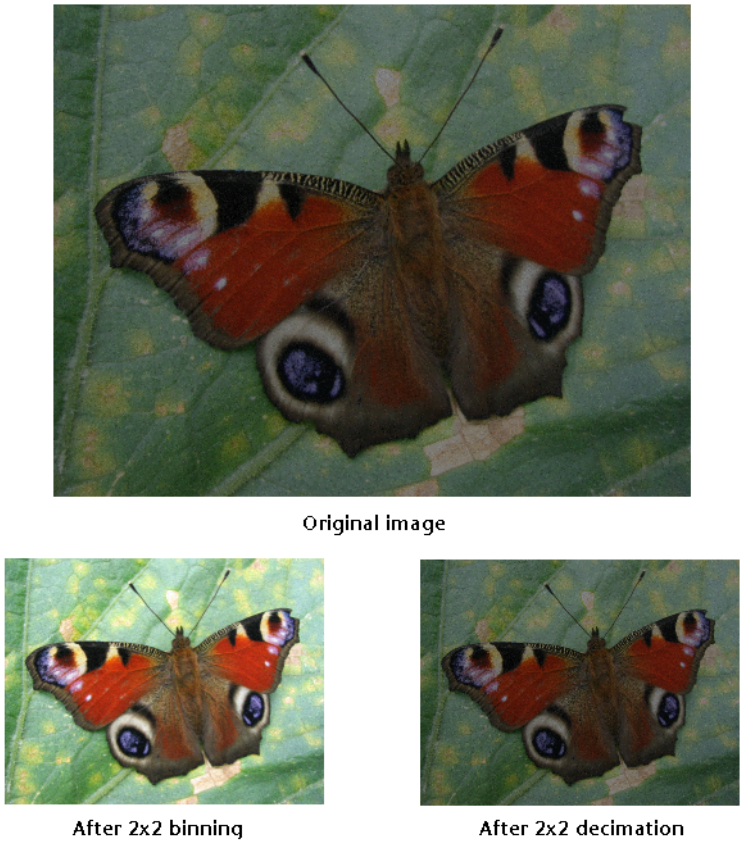


*Figure 6.5. Binning and decimation example*

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure 2x2 binning
LvSetInt32 (hDev, LvDevice_BinningHorizontal, 2);
LvSetInt32 (hDev, LvDevice_BinningVertical, 2);
// configure 2x2 decimation
LvSetInt32 (hDev, LvDevice_DecimationHorizontal, 2);
LvSetInt32 (hDev, LvDevice_DecimationVertical, 2);
```

GEN<i>CAM

```
// configure 2x2 binning
write_int (BinningHorizontal, 2)
write_int (BinningVertical, 2)
// configure 2x2 decimation
write_int (DecimationHorizontal, 2)
write_int (DecimationVertical, 2)
```

*Since the binning/decimation might increase the maximal acquisition frame rate, they might have also an impact on the exposure time limits. In free running mode, the maximal exposure time depends on the current frame rate — it cannot be increased beyond a point, when longer exposures would slow down the acquisition. In conclusion, adjusting binning/decimation might lead to lowering the exposure time range and the exposure time would be automatically adjusted to fit in the new range. In triggered mode, the exposure time limits are not affected.*

#### 6.5.2.1. Binning/decimation on color cameras

The color (Bayer encoded) cameras supporting binning and/or decimation implement it intelligently, merging/skipping pixels of corresponding colors in the Bayer mosaic filter. The output is thus always a correct Bayer pattern compatible with the natural pattern of the sensor. The color representation is not destroyed.

### 6.5.3. Image size, area of interest (AOI)

Another option to reduce image resolution is area of interest (AOI) feature. Area of interest is a configurable rectangular area within the image sensor, that is read out and transferred to the application buffer. Pixels outside this defined area are ignored. Contrary to binning/decimation, AOI reduces the field of view. The effect on frame rate depends on the camera model, size and position of the AOI rectangle within the sensor.

The AOI functionality is available on all camera models.

The area of interest is defined by four basic parameters, specifying the size and offset within the "parent" area (which is, in the most simple case, full sensor size):

*Width*/*Height* Dimensions of the area of interest, in pixels.

*X Offset*/*Y Offset* Offset of the area of interest, relative to the top-left corner of the parent area (sensor), in pixels.

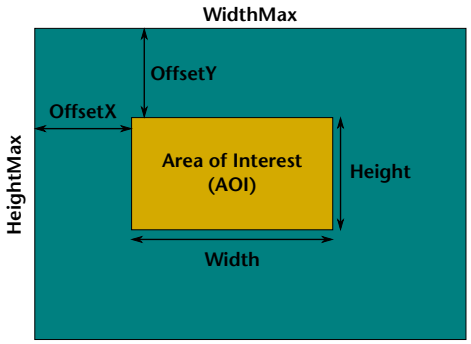


*Figure 6.6. AOI parameters*

*Figure 6.7. AOI example*

In the default mode, only the AOI size is configurable, the x/y offsets (position within the sensor area) are selected automatically by the camera to optimize performance. This typically means that the area of interest is centered within the sensor. On some cameras only *Height* is configurable.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// decrease AOI size to 300x200 pixels
LvSetInt32 (hDev, LvDevice_Width, 300);
LvSetInt32 (hDev, LvDevice_Height, 200);
// read current maximum AOI size
// (depends on binning/decimation, see below)
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_WidthMax, &IntVal);
LvGetInt32 (hDev, LvDevice_HeightMax, &IntVal);
// check entire sensor size (in pixels)
LvGetInt32 (hDev, LvDevice_SensorWidth, &IntVal);
LvGetInt32 (hDev, LvDevice_SensorHeight, &IntVal);
```

GEN<i>CAM

```
// decrease AOI size to 300x200 pixels
write_int (Width, 300)
write_int (Height, 200)
// read current maximum AOI size
```

```
// (depends on binning/decimation, see below)
read_int (WidthMax)
read_int (HeightMax)
// check entire sensor size (in pixels)
read_int (SensorWidth)
read_int (SensorHeight)
```

More elaborate options to configure area of interest will be shortly discussed below.

*Since the AOI settings might increase the maximal acquisition frame rate, they might have also an impact on the exposure time limits. In free running mode, the maximal exposure time depends on the current frame rate — it cannot be increased beyond a point, when longer exposures would slow down the acquisition. In conclusion, adjusting AOI might lead to lowering the exposure time range and the exposure time would be automatically adjusted to fit in the new range. In triggered mode, the exposure time limits are not affected.*

*When decreasing the AOI to very small size, the acquisition frame rate can increase significantly, having unwanted impact on system performance due to increased overhead. The actual behavior is strongly dependent on the used sensor, system configuration and other conditions and cannot be exactly quantified. The developer should consider possible impact of using extremely small AOI size on the system performance and reliability.*

### 6.5.3.1. AOI limits

Two pairs of helper read-only features provide information related to maximal size of the area of interest under given conditions:

*Sensor Width*/*Sensor Height*
: Effective resolution of the image sensor, specifying the number of useful pixels that can be read out of the sensor. These values are fixed for a given camera model. In the default mode (no binning, decimation, or area of interest), the image dimensions equal to *Sensor Width* and *Sensor Height*.

*Max Width*/*Max Height*
: These values specify the maximum possible size of the area of interest in current configuration. This maximum size can be affected by features such as binning, which reduce the effective sensor size. When no binning/decimation is active, *Max Width*×*Max Height* are equal to *Sensor Width*×*Sensor Height*.

### 6.5.3.2. AOI and binning/decimation

When binning or decimation is active, the area of interest is applied to the virtual sensor area resulting from the binning/decimation operation. In this case, the *Max Width* and *Max Height* features report the size resulting from binning/decimation, ie. sensor size reduced by given factor(s). Take this in account when using the two features together.

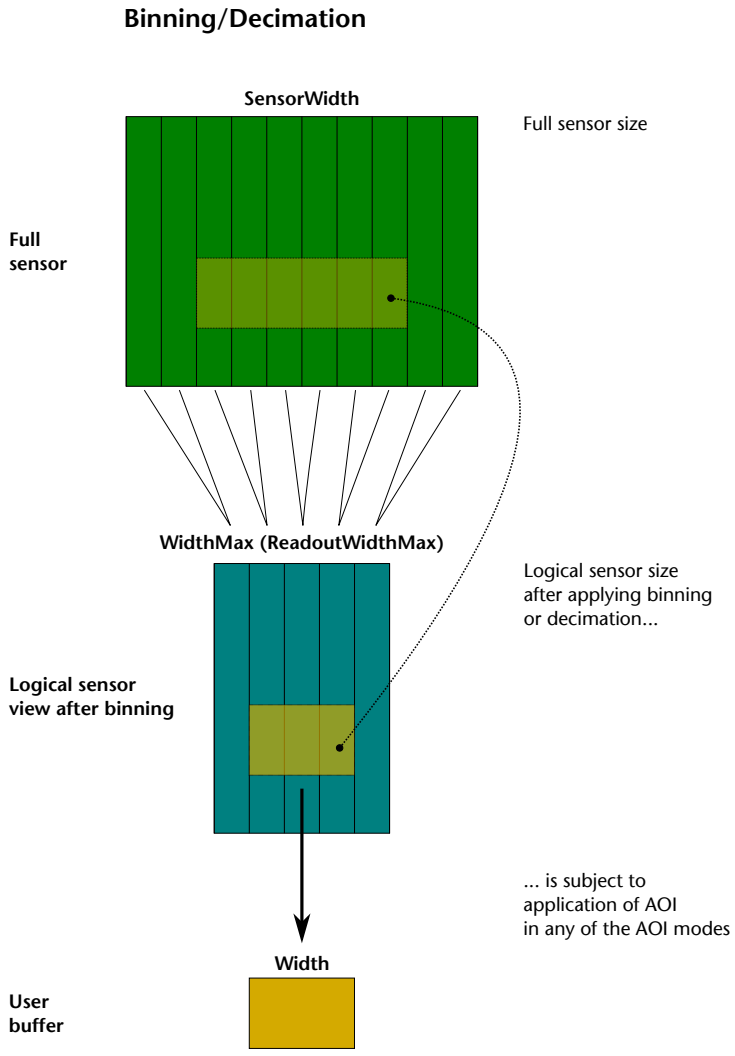


*Figure 6.8. AOI and binning*

### 6.5.3.3. AOI on color cameras

On the color (Bayer encoded) cameras, the AOI settings, size an offset, can only be adjusted with increment of 2 to keep the same Bayer mosaic format in the buffer, regardless the actual AOI configuration.

## 6.5.4. Advanced AOI settings

While the default “automatic” mode described above is sufficient in most cases, some applications might require greater control over the AOI settings.

### 6.5.4.1. Two-step AOI implementation

In general, there are two points, where area of interest can be applied:

Sensor

The camera might configure the sensor to read out only the specified area of interest. This attitude has the advantage, that the AOI has direct impact on the frame rate (the smaller AOI, the faster readout and frame rate).

On the other hand, this implementation is strongly sensor specific. Some sensors do not allow to reduce AOI in both directions, others

impose additional constraints, such as that the AOI has to be centered within the sensor. The functionality would thus be quite limited on some camera models. It is not allowed to reconfigure sensor-side AOI during active acquisition.

Camera frame buffer

The camera could alternatively read out the entire image from the sensor into its frame buffer and apply the area of interest (clip the image) before transferring it out to the host memory (application buffer). In this case, the AOI settings have no impact on the sensor readout time and frame rate. Only the required bandwidth for image transfer decreases — that means lower network load for PicSight-GigE, lower PCI/DMA load for CheckSight.

The advantage of this attitude is that the AOI can be configured freely, without any constraints. The AOI parameters can even be, if desired, changed on-the-fly, during active acquisition. The programmer just needs to understand all the consequences of variable image size during acquisition — this topic is discussed in Section 6.5.5, “Fixed vs. variable payload size” [p. 122].

Leutron Vision cameras allow to combine both attitudes flexibly through various “AOI modes”.

### 6.5.4.2. AOI modes

The AOI modes are configured through the enumerated feature *AOI Mode*. Depending on the selected AOI modes, the camera decides, how to interpret the AOI parameters, or even enables additional parameters.

The available modes are:

- *Automatic*
- *Clip on Transfer*
- *Manual*

#### Automatic AOI mode

This is the default mode and was described above (Section 6.5.3, “Image size, area of interest (AOI)” [p. 111]).

- Only the AOI size (*Width*/*Height*) is configurable. Its position (*X Offset*/*Y Offset*) is chosen by the camera — usually centered within the sensor, unless the sensor disallows that.
- The camera automatically “distributes” the AOI implementation among the two options, sensor-side and in-memory-clip. It tries to apply as much as possible directly on the sensor to increase the frame rate as much as possible. If sensor AOI capabilities are limited, it additionally clips the image in-memory before the transfer, to reach the desired AOI settings.
- The AOI parameters cannot be changed during active acquisition.

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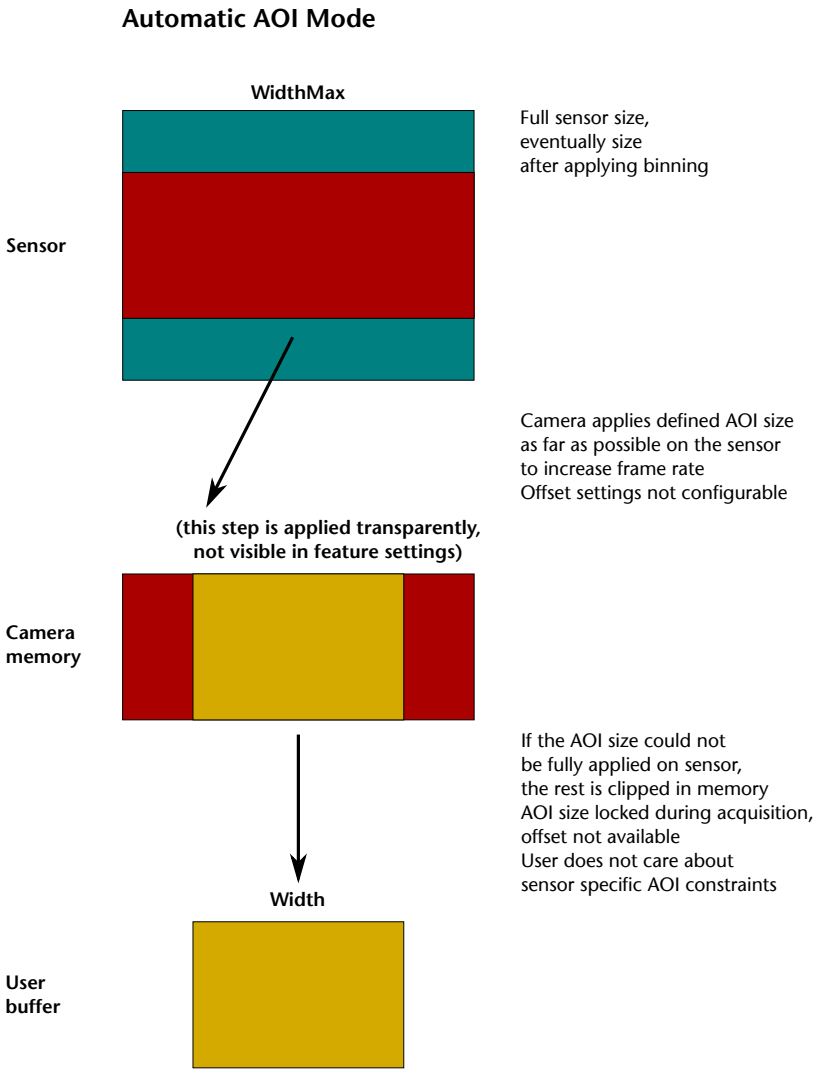


*Figure 6.9. Automatic AOI mode*

Simplon

```
LvHDevice hDev; // open the device to get the handle
// select automatic AOI mode
LvSetEnum (hDev, LvDevice_LvAOIMode, LvAOIMode_Automatic);
// adjust AOI size to 300x200 pixels
LvSetInt32 (hDev, LvDevice_Width, 300);
LvSetInt32 (hDev, LvDevice_Height, 200);
```

GEN<i>CAM

```
// select automatic AOI mode
write_enum (LvAOIMode, Automatic)
// adjust AOI size to 300x200 pixels
write_int (Width, 300)
write_int (Height, 200)
```

### Clip-on-transfer AOI mode

This mode allows free control over AOI parameters, optionally even at runtime. It might not be implemented on all camera models since the same functionality can be achieved using the "manual" mode.

- The AOI is fully applied in camera memory — the image is "clipped" before transferring out of the camera.
- Since sensor settings are not involved, the AOI has no positive impact on the frame rate.
- All four AOI parameters, *Width*/*Height* and *X Offset*/*Y Offset*, are freely configurable. No sensor specific constraints apply.
- Offsets are configurable during active acquisition.
- Size can be configurable during acquisition, see Section 6.5.5, "Fixed vs. variable payload size" [p. 122].

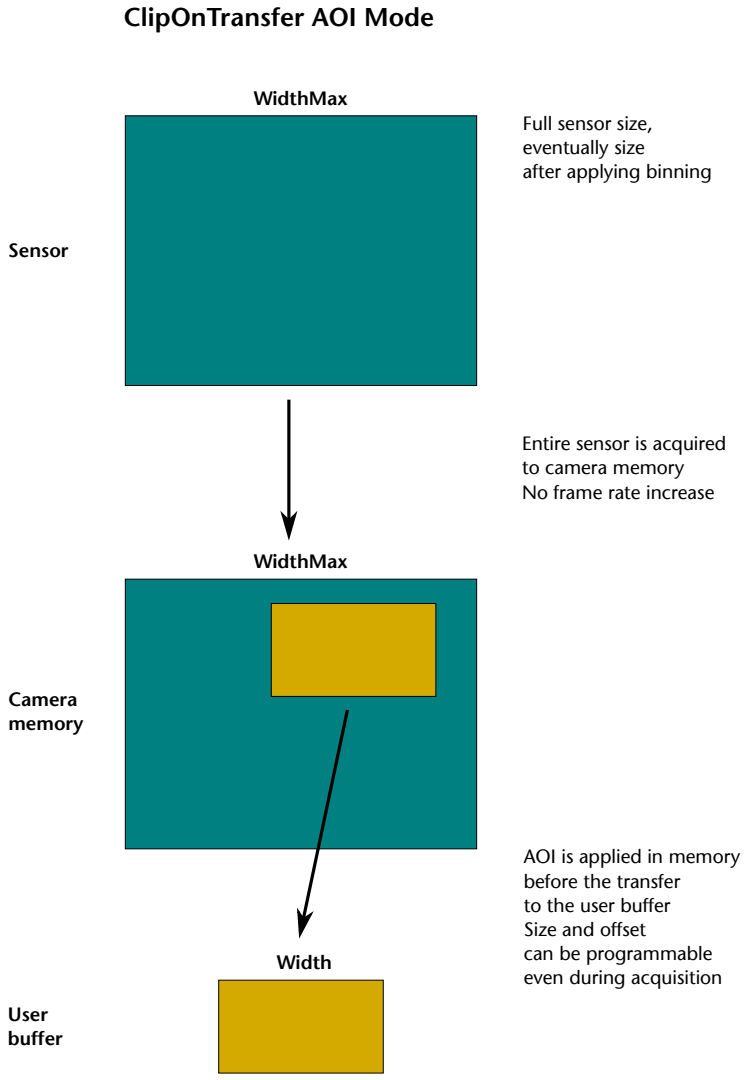


*Figure 6.10. Clip-on-transfer AOI mode*

```
LvHDevice hDev; // open the device to get the handle
// select clip-on-transfer AOI mode
LvSetEnum (hDev, LvDevice_LvAOIMode, LvAOIMode_ClipOnTransfer);
```

```
// adjust AOI size to 300x200 pixels
// with offset 100 pixels from top and left image sides
// (note that the order of setting the size and offset values
// might matter as described later)
LvSetInt32 (hDev, LvDevice_Width, 300);
LvSetInt32 (hDev, LvDevice_Height, 200);
LvSetInt32 (hDev, LvDevice_OffsetX, 100);
LvSetInt32 (hDev, LvDevice_OffsetY, 100);
```

GEN<i>CAM

```
// select clip-on-transfer AOI mode
write_enum (LvAOIMode, ClipOnTransfer)
// adjust AOI size to 300x200 pixels
// with offset 100 pixels from top and left image sides
// (note that the order of setting the size and offset values
// might matter as described later)
write_int (Width, 300)
write_int (Height, 200)
write_int (OffsetX, 100)
write_int (OffsetY, 100)
```

### Manual AOI mode

The most flexible mode, allowing elaborate options for AOI configuration.

- The AOI can be configured in two separate steps: sensor-readout and in-memory-clip AOI. The first one defines the region to be read out from a sensor into the camera memory. The second AOI is applied to this region directly in camera memory (clipped before the transfer).
- The sensor-readout AOI is tightly coupled with capabilities of each respective sensor. All sensor specific constraints apply — examples: only height is configurable, the AOI has to be centered, etc.
- Four additional parameters are introduced in the manual AOI mode to define the sensor-readout AOI part: *Readout Width*, *Readout Height*, *Readout XOffset* and *Readout Y Offset*. If no binning and decimation is applied, the size limits are equal to the sensor size (*Sensor Width*/*Sensor Height*). When using binning or decimation, the size limits are defined by the result of the binning/decimation operation (sensor size divided by the binning/decimation factor).
- The readout AOI parameters are not configurable during active acquisition.
- The second step is performed in the camera's frame buffer memory, after readout, and is equivalent to the “clip-on-transfer” AOI mode. It has all properties of that mode — in particular: the parameters are freely configurable without constraints, offsets are configurable during acquisition, size might be configurable during acquisition (Section 6.5.5, “Fixed vs. variable payload size” [p. 122]).
- The “in-memory-clip” AOI step is configured through the “regular” AOI parameters, ie. *Width*/*Height* and *Y Offset*/*Y Offset*. The AOI size limits are reported through *Max Width* and *Max Height*, which are defined by the readout AOI size.

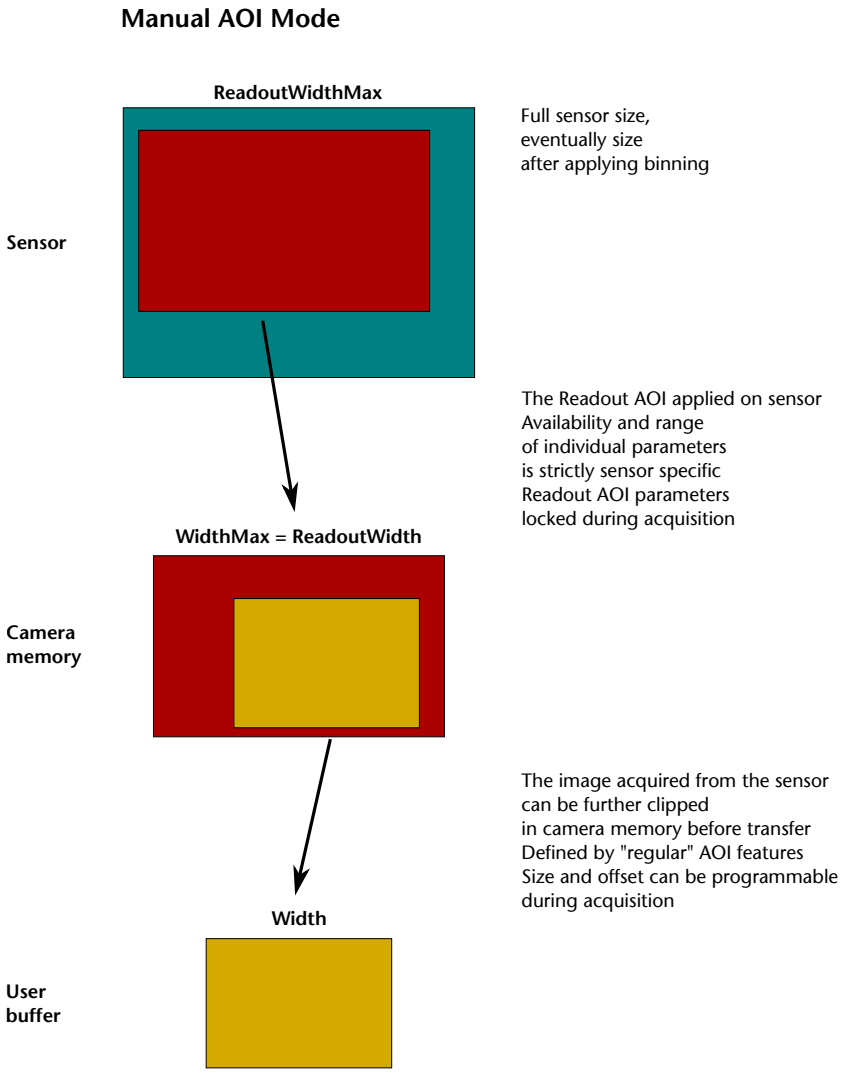


*Figure 6.11. Manual AOI mode*

```
LvHDevice hDev; // open the device to get the handle
// select manual AOI mode
LvSetEnum (hDev, LvDevice_LvAOIMode, LvAOIMode_Manual);
// adjust the sensor readout AOI parameters
// (note that on most sensors only a subset of the parameters
// would be configurable)
LvSetInt32 (hDev, LvDevice_LvReadoutWidth, 600);
LvSetInt32 (hDev, LvDevice_LvReadoutHeight, 400);
LvSetInt32 (hDev, LvDevice_LvReadoutOffsetX, 200);
LvSetInt32 (hDev, LvDevice_LvReadoutOffsetY, 200);
// now adjust the in-memory-clip AOI parameters
// (note again that the order of setting the size and offset values
// might matter as described later)
LvSetInt32 (hDev, LvDevice_Width, 300);
LvSetInt32 (hDev, LvDevice_Height, 200);
LvSetInt32 (hDev, LvDevice_OffsetX, 100);
LvSetInt32 (hDev, LvDevice_OffsetY, 100);
```

GEN<i>CAM

```
// select manual AOI mode
write_enum (LvAOIMode, Manual)
// adjust the sensor readout AOI parameters
// (note that on most sensors only a subset of the parameters
// would be configurable)
write_int (LvReadoutWidth, 600)
write_int (LvReadoutHeight, 400)
write_int (LvReadoutOffsetX, 200)
write_int (LvReadoutOffsetY, 200)
// now adjust the in-memory-clip AOI parameters
// (note again that the order of setting the size and offset values
// might matter as described later)
write_int (Width, 300)
write_int (Height, 200)
write_int (OffsetX, 100)
write_int (OffsetY, 100)
```

### Order of image format settings

When combining multiple image format settings, it is important to adjust them in correct order, since each step defines the limits for the following step, and a virtual intermediate image to which the consecutive step is applied. The correct procedure is:

1. **AOI mode.** The AOI mode defines, which parameters will be configurable and what will be their limits.

2. **Binning/decimation.** The intermediate image resulting from the binning/decimation operation is a basis for the AOI settings.

3. **Readout AOI.** If in manual AOI mode, adjust the readout AOI parameters first. The result of the readout AOI operation defines a basis for the transfer AOI step (in-memory clipping).

4. **Transfer AOI.** This are the “regular” AOI parameters, available in all AOI modes. They define the final image size that will be transferred to the host application buffers.

5. **Other parameters.** The other image format related parameters, such as pixel format are independent from the image size-related settings and can be applied at any point.

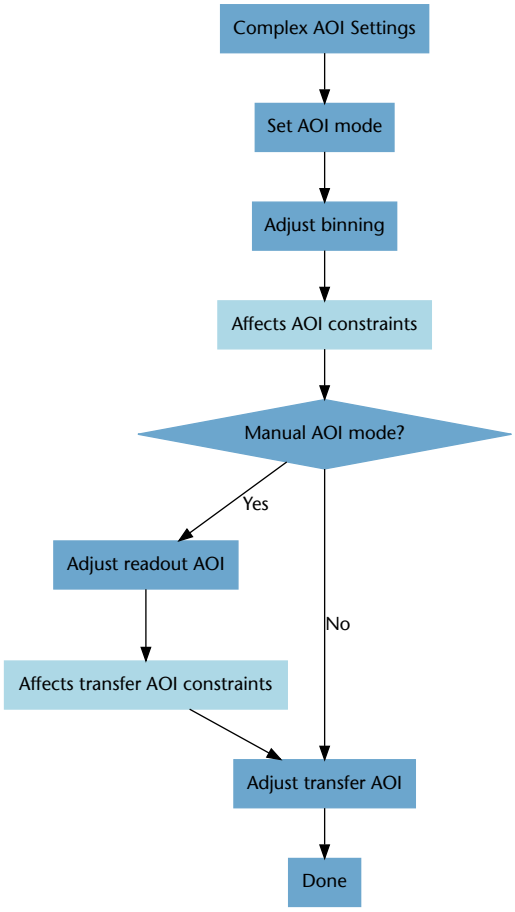


*Figure 6.12. Flow chart: image format configuration options*

### 6.5.4.3. AOI parameter dependencies

When working with AOI, it's important to understand the dependencies between the size and offset parameters. The configured area of interest must naturally fall fully into the sensor area. Thus the sum of an offset with its corresponding size parameter must not exceed the current maximum size (which in turn might depend on other features such as binning): `OffsetX+Width<=WidthMax`, `OffsetY+Height<=HeightMax`.

The current *Width* implies the maximum possible *X Offset* and vice versa (similar for vertical settings). For example when AOI width is equal to the sensor size, the horizontal offset must naturally remain `0` — to be able to increase offset, one has to decrease the width first. The limits for the AOI parameters can be expressed in simple equations:

- $\texttt{OffsetX}_{max}$ = WidthMax - Width
- $\texttt{Width}_{max}$ = WidthMax - OffsetX
- $\texttt{OffsetY}_{max}$ = HeightMax - Height
- $\texttt{Height}_{max}$ = HeightMax - OffsetY

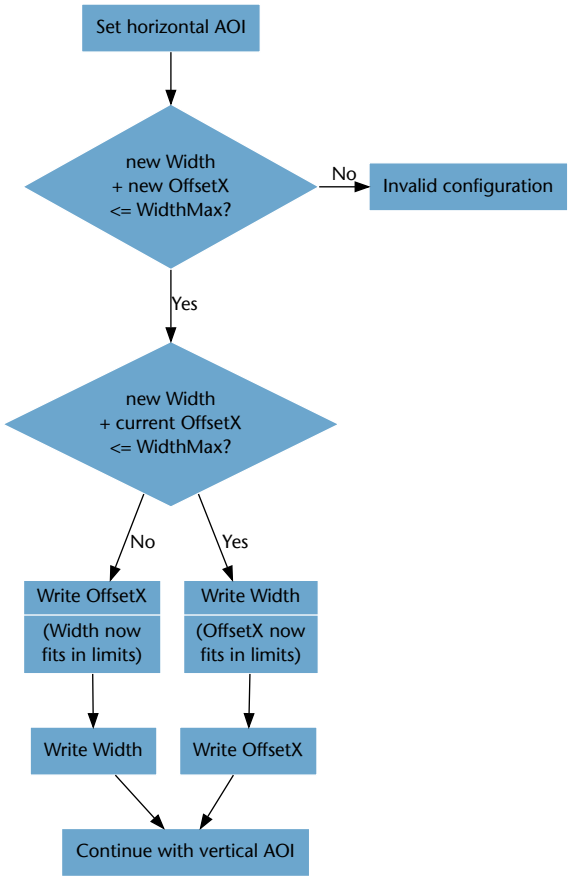


*Figure 6.13. Flow chart: AOI parameter dependencies*

## 6.5.5. Fixed vs. variable payload size

The image format features are (together with the chunk data configuration, Section 6.11, “Chunk data” [p. 168]) affecting the size of the data the camera transfers to the host. The application has to allocate buffers large enough to hold the entire data, otherwise the acquisition fails.

The size of the image data (“payload”) the camera is going to transfer is reported in the *Payload Size* feature — the application is expected to use query this reported size when allocating the acquisition buffers.

By default, the payload size is fixed during acquisition, the camera transfers the same amount of data for each acquired image.

If the application desires, however, to change image size during acquisition, special care has to be taken, since the actual amount of data could differ from image to image. Such mode has to be enabled explicitly by setting the *Variable Payload Size* flag. This has two effects:

- The *Width*/*Height* AOI parameters become configurable during acquisition (in manual and clip-on-transfer AOI modes). The image size can change from image to image.
- The *Payload Size* feature does not report the data size corresponding with the *current* image size, but with *maximal* image size. This assures that the reported size is large enough to hold the entire image data, however the image size can change during the acquisition. The buffers allocated using the *Payload Size* will be safe to hold the entire image data during entire acquisition.

The application needs to keep track of the actual image size for every single image, so that it interprets the buffer correctly. It can do so using three mechanisms:

- The camera can report the image size in the chunk data (Section 6.11, “Chunk data” [p. 168]). When connecting the cameras through other software than Simplon API, check if your library supports chunk data decoding.
- The parameters of the image acquired in each respective buffer can be retrieved through the GenTL interface. Simplon API provides direct access to these info fields.
- The GigE Vision compatible cameras (PicSight-GigE and PicSight-Smart) report the image size also in GigE Vision control packets. When connecting the cameras through other software than Simplon API, check if your library provides the information from the control packets and how.

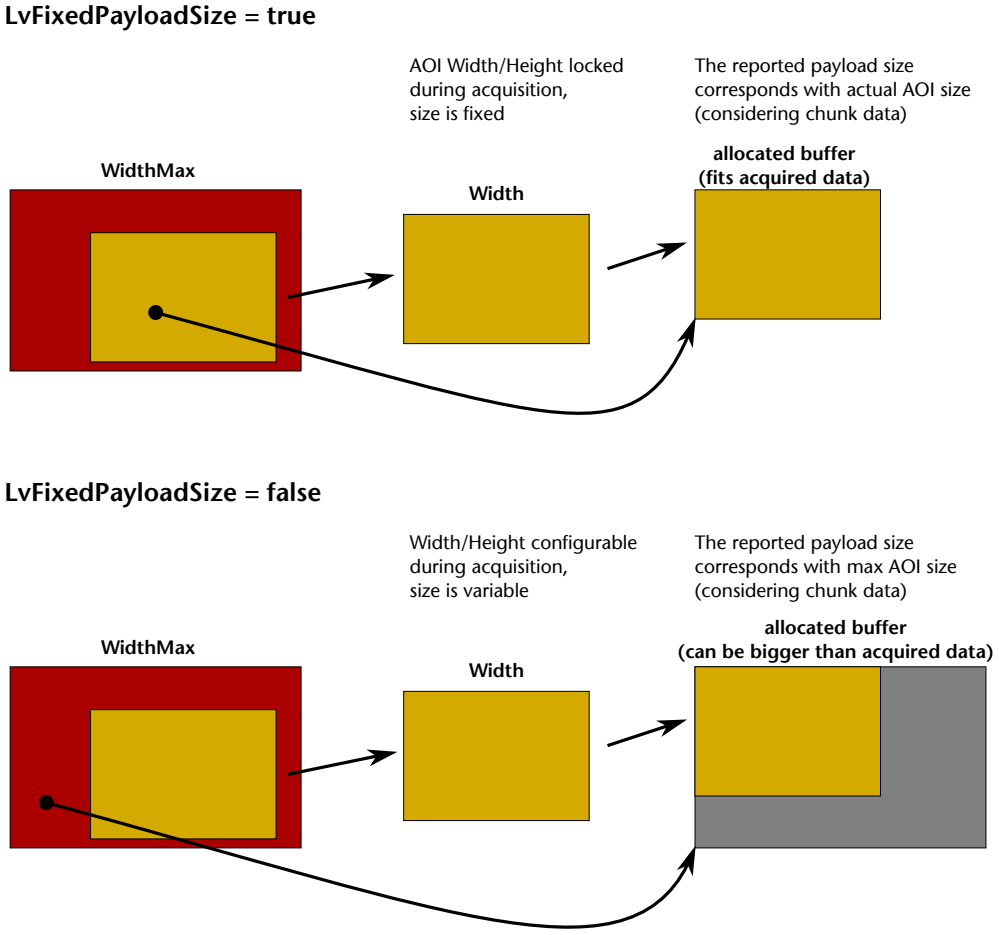
LvFixedPayloadSize = true
AOI Width/Height locked during acquisition, size is fixed
The reported payload size corresponds with actual AOI size (considering chunk data)
WidthMax
Width
allocated buffer (fits acquired data)
LvFixedPayloadSize = false
Width/Height configurable during acquisition, size is variable
The reported payload size corresponds with max AOI size (considering chunk data)
WidthMax
Width
allocated buffer (can be bigger than acquired data)

*Figure 6.14. Variable payload size*

Simplon

```
LvHDevice hDev; // open the device to get the handle
// use variable payload size
// (the PayloadSize feature reports max possible size)
LvSetBool (hDev, LvDevice_LvVariablePayloadSize, 1);
// use fixed payload size
// (the PayloadSize feature reports actual size)
LvSetBool (hDev, LvDevice_LvVariablePayloadSize, 0);
// ...after finishing the configuration, read payload size feature
// and use it for the buffer allcoation
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_PayloadSize, &IntVal);
```

GEN<i>CAM

```
// use variable payload size
// (the PayloadSize feature reports max possible size)
write_bool (LvVariablePayloadSize, true)
// use fixed payload size
// (the PayloadSize feature reports actual size)
write_bool (LvVariablePayloadSize, false)
// ...after finishing the configuration, read payload size feature
// and use it for the buffer allcoation
read_int (PayloadSize)
```

# 6.6. Acquisition and trigger control

This section discusses all features related to image acquisition, from essential acquisition control, exposure time, frame rate to trigger modes.

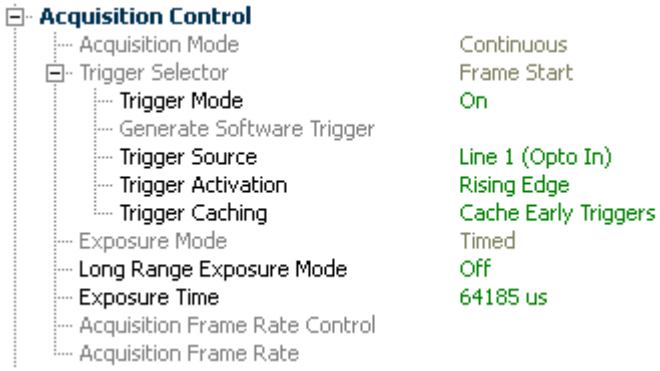


*Figure 6.15. Example GUI showing the acquisition and trigger features*

## 6.6.1. Basic acquisition control

The camera delivered off factory always starts in “free running” mode — as soon as the acquisition is started, it acquires images in highest possible frame rate, without need for any triggering.

The basic acquisition control is, in all working modes, done using few basic camera features:

*Acquisition Mode* — This enumeration is a mandatory feature for GigE Vision cameras — hence it is implemented on all our camera families, even if they currently support only a single acquisition mode, *Continuous*. Setting this feature is thus optional.

*Acquisition Start* — Command that actually starts the acquisition. In free running mode, the camera starts immediatelly grabbing and streaming images. In triggered mode the images will be acquired upon valid triggers. Simplon API encapsulates this command in `LvDeviceAcquisitionStart()`, together with additional startup actions.

*Acquisition Stop* — Command stopping the acquisition. In free running mode the acquisition stops after finishing the current frame. In triggered mode no more triggers will be accepted. Simplon API encapsulates this command in `LvDeviceAcquisitionStop()`, together with additional stopping actions.

*Acquisition Arm* — Optional command that puts the camera to a status ready for acquisition. It performs some initialization and verification routines otherwise handled during acquisition start. It is optional, though, if omitted, if will be ex-

ecuted implicitly during acquisition start. The command is not needed with Simplon API.

`TLParamsLocked` This feature belong to the “transport layer features” category, Section 6.4, “Transport layer control” [p. 102]. Its purpose is to “lock” the features essential for the transport layer (software component transporting the image data to the application buffers). Once set, the crucial acquisition parameters will become locked — most importantly the *Payload Size*, value indicating the required size of the acquisition buffers. Having this feature locked guarantees that the user cannot cause accidental buffer overflows by changing camera configuration.

The GenICam standard dictates that this feature is set throughout the entire acquisition.

Simplon API handles `TLParamsLocked` transparently while starting/stopping the acquisition. When using the camera with another software package, it is important that the feature is set properly before starting the acquisition, otherwise any attempt to start the acquisition will fail (the acquisition start command will not be executable).

In Simplon API, none of these features (with exception of the acquisition mode) are accessed directly, Simplon API does that automatically within the `LvDeviceAcquisitionStart()` and `LvDeviceAcquisitionStop()` functions. The steps needed to initialize a Simplon API application and prepare it for acquisition should be studied in Simplon programmer's guide.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// how to control acquisition:
// optional: set explicitly the acquisition mode
LvSetEnum (hDev, LvDevice_AcquisitionMode, LvAcquisitionMode_Continuous);
// configure essential features such as trigger mode and image format
// perform other basic Simplon initialization, as indicated in its manual
// when finished, read required buffer size and allocate buffers
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_PayloadSize, &IntVal);
// start and stop the acquisition, as desired, Simplon API
// controls the underlying features automatically under the hood
while (NewAcquisitionsDesired)
{
    LvDeviceAcquisitionStart (hDev);
    // ... acquire images as long as desired
    LvDeviceAcquisitionStop (hDev);
}
// if desired, reconfigure the camera and start again
```

In 3rd party GenICam based software package, similar attitude might be expected — ie. the acquisition related features might be hidden and wrapped into dedicated functions. The following pseudocode anyway demonstrates the required procedure to start and stop the acquisition, but remember that a typical GenICam aware library does this completely for you under the hood:

GENICAM

```
// how to control acquisition:
// optional: set explicitly the acquisition mode
write_enum (AcquisitionMode, Continuous)
// configure essential features such as trigger mode and image format
// optional: 'arm' the camera (prepare it for acquisition)
```

```
exec_cmd (AcquisitionArm)
// lock the transport layer parameters, as required by GenICam standard
write_int (TLParamsLocked, 1)
// now it is possible to read the required buffer size, and allocate buffers
// the size will not change as long as TLParamsLocked is set
read_int (PayloadSize)
// start and stop the acquisition, as desired
while (NewAcquisitionsDesired)
{
    exec_cmd (AcquisitionStart)
    // ... acquire images as long as desired
    exec_cmd (AcquisitionStop)
}
// unlock the transport layer parameters
write_int (TLParamsLocked, 0)
// if desired, reconfigure the camera and start again
```

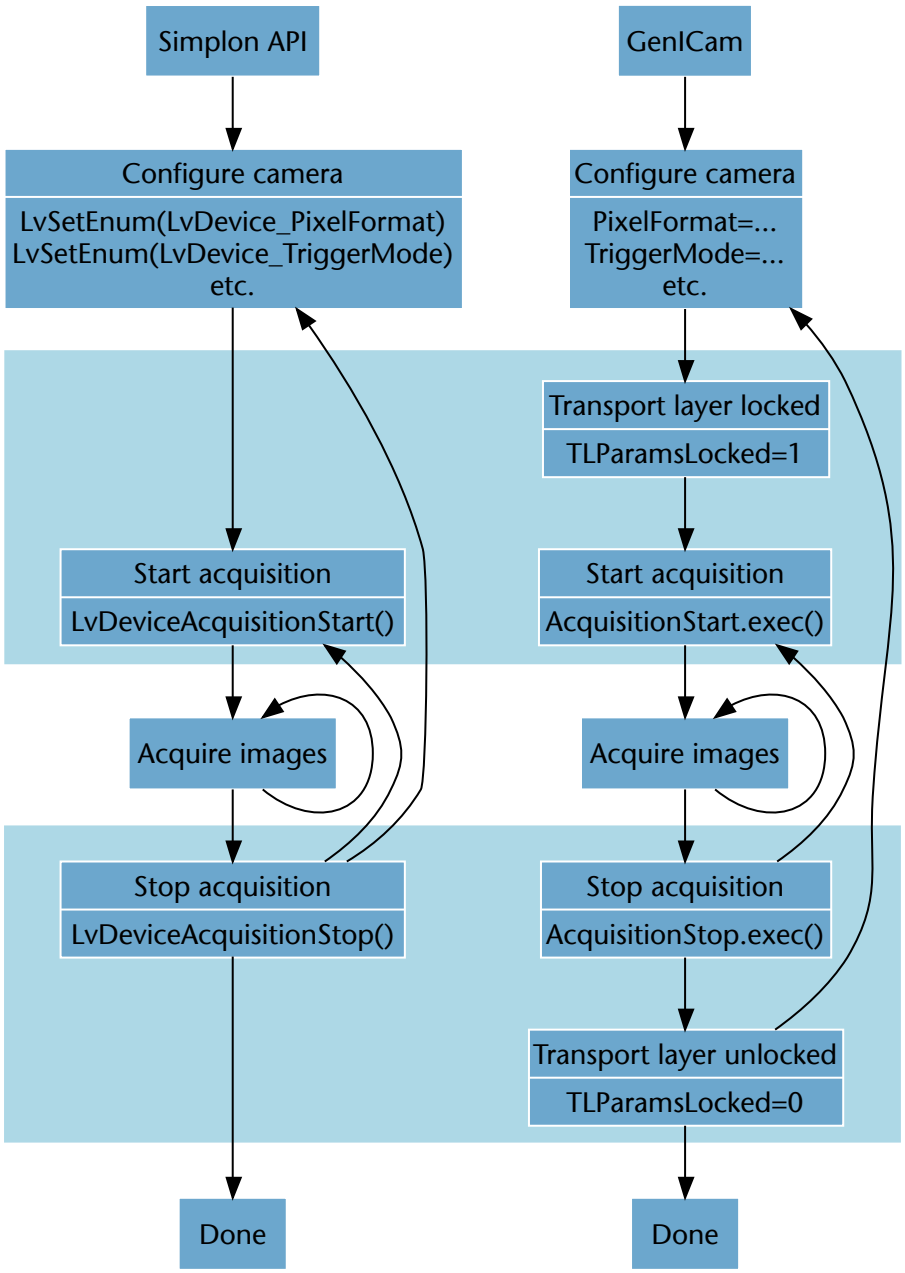


*Figure 6.16. Flow chart: acquisition control in Simplon API and in generic GenICam application*

## 6.6.2. Exposure time

The direct setting of exposure time is trivial, through the *Exposure Time* feature, which is a floating point value in µs.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure exposure time in microseconds
LvSetFloat (hDev, LvDevice_ExposureTime, 1000.0);
```

GENICAM

```
// configure exposure time in microseconds
write_float (ExposureTime, 1000.0)
```

*The actual range of possible exposure times depends on other settings, in particular:*

- *Working mode — free running or triggered, long range exposure mode (see below)*
- *Area of interest (AOI) settings*
- *Binning/decimation settings*
- *Frame rate settings*

Note that the camera might be able to adjust the exposure time only in small but discrete steps. It will align the requested value to the closest "step" — to know the exact used value, the application might want to re-read the exposure time after setting it.

*On certain camera models (in particular those based on the G43A sensor), the exposure time is applied with a delay of one frame. The one frame delay also applies for sensor R312AB, but only in triggered mode.*

Related topic of controlling gain and black level is discussed in separate section, Section 6.9, "Analog controls" [p. 149].

### 6.6.2.1. Automatic exposure

The automatic exposure function is available only on those camera models, whose sensor supports that function natively. It is useful for applications capturing scenes exposed to significantly varying illumination, when it's necessary to protect the acquired images against under- or over-exposition.

The automatic exposure algorithm observes the luminance of acquired images and attempts to keep it at constant level, by compensating for any changes by adjusting the exposure time for subsequent frames. To prevent flickering, the adjustments are low-pass fltered — it may take several frames until the target luminance is restored again.

To switch the camera to automatic exposure (if supported by the camera), you switch the *Automatic Exposure* enumeration from *Off* to *Continuous*. The exposure time itself will become read-only since that feature is now under control of the camera firmware

Simplon

```
LvHDevice hDev; // open the device to get the handle
// switch to automatic exposure mode
if (LvIsAvailableEnumEntry(hDev, LvDevice_ExposureAuto,
                                 LvExposureAuto_Continuous))
{
    LvSetEnum (hDev, LvDevice_ExposureAuto, LvExposureAuto_Continuous);
}
// switch back to the direct control of exposure time
LvSetEnum (hDev, LvDevice_ExposureAuto, LvExposureAuto_Off);
```

GEN<i>CAM

```
// switch to automatic exposure mode
write_enum (ExposureAuto, Continuous)
// switch back to the direct control of exposure time
write_enum (ExposureAuto, Off)
```

*When used together with the automatic gain feature (Section 6.9, "Analog controls" [p. 149]), the auto exposure takes precedence. Automatic gain is inactive as long as the automatic exposure functinality does not reach its limits — only then the automatic gain becomes active as well.*

*The automatic exposure functionality might work against the manual gain settings. When increasing the gain, the automatic exposure function will decrease the exposure to reach again the target luminance level.*

*The low pass filter applied in the automatic exposure algorithm can cause, that the automatic exposure value never fully reaches the limits (min/max) of the manual exposure time.*

#### 6.6.2.2. Exposure mode

To make the discussion complete, we should also mention the *Exposure Mode* feature. It is an enumeration, which is currently present mainly as information for generic applications relying on the GenICam SFNC (Standard Features Naming Convention) standard — since all Leutron Vision cameras currently use just a single exposure mode in all working mode.

The supported exposure mode is *Timed*, which means that the exposure time is fully controlled by features *Exposure Time* and *Automatic Exposure*, both discussed above. In particular, in the triggered mode, the trigger width has no impact on the exposure time.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// optionally set the exposure mode
// ('Timed' is anyway currently the only, thus default, option)
LvSetEnum (hDev, LvDevice_ExposureMode, LvExposureMode_Timed);
```

GEN<i>CAM

```
// optionally set the exposure mode
// ('Timed' is anyway currently the only, thus default, option)
write_enum (ExposureMode, Timed)
```

*On an older series of PicSight-GigE cameras, "Trigger Width" exposure mode was used when triggering over the TTL input. In this mode, the exposure time was controlled by the width of the trigger signal. These legacy cameras are, however, obsolete, and the "Trigger Width" more is no more available on current camera series.*

### 6.6.3. Trigger modes

The following sections give an overview of the trigger modes supported by the cameras. Detailed timing specifications are model specific.

#### 6.6.3.1. Free running mode

In the free running mode no external triggers are considered by the camera. A continuous video stream with constant frame rate (see Appendix A, *Technical specifications for individual models* [p. 293]) is output by the camera. Exposure time is programmable.

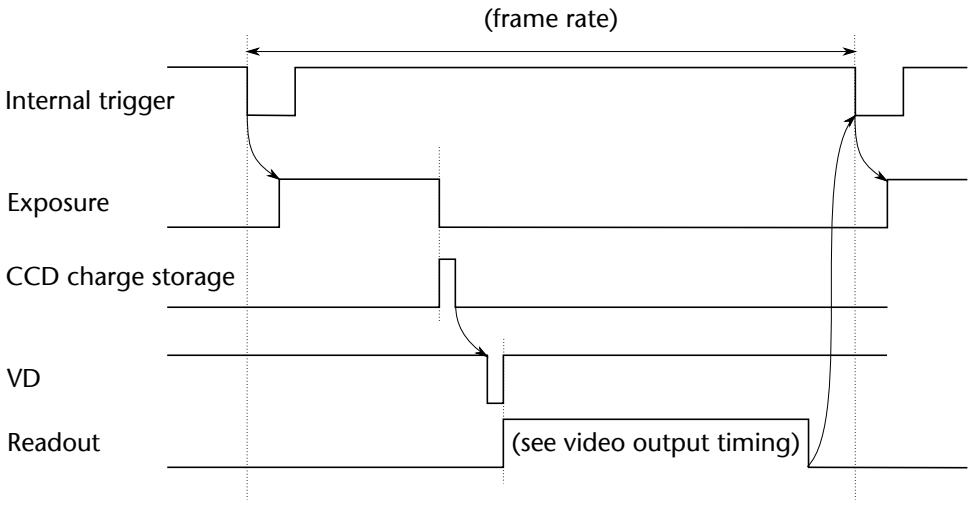


*Figure 6.17. Free running mode timing*

### 6.6.3.2. Triggered mode (accurate exposure)

In the triggered mode only the leading edge of the trigger pulse is significant. When encountered an exposure starts, eventually after a programmable delay. The length of the exposure is programmable.

The trigger should be delivered through one of the input lines (see Section 3.7.4, “Trigger input” [p. 40], Section 3.8, “Connector and cable description” [p. 44]). The trigger pulse duration should be at least 2 H. Trigger overlapping is not supported, therefore the maximum frame rate in triggered mode is always lower than the frame rate in free running mode.

The programmable exposure time range is limited, but the exposure timing is accurate (no jitter) across the entire range.

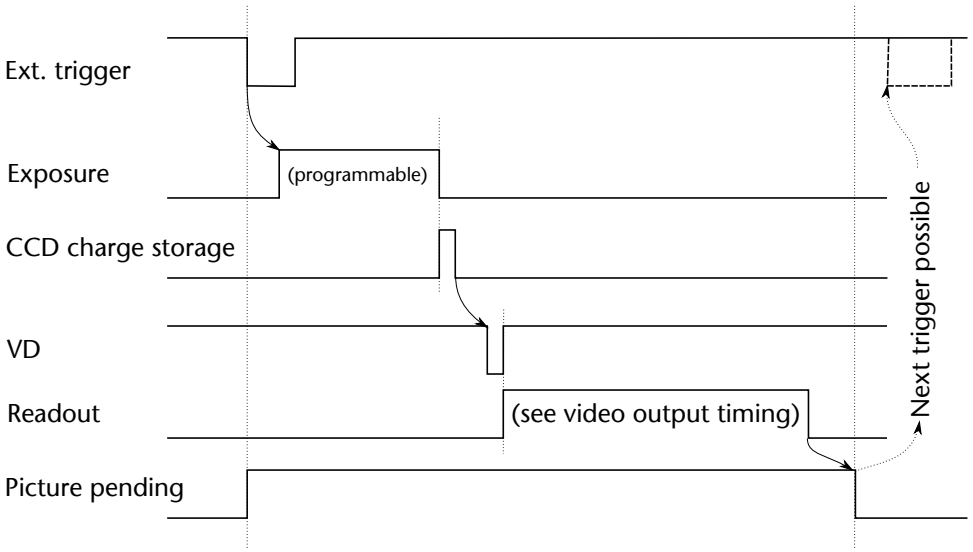


*Figure 6.18. Triggered mode timing*

### 6.6.3.3. Triggered mode (long range exposure)

Long range exposure mode is an alternative to the accurate exposure mode. The two modes are functionally equivalent, the long range exposure mode differs only in two aspects:

- The exposure time range is extended towards long time exposures.
- The short exposure times might be affected by a jitter.

### 6.6.3.4. Trigger modes of the CMOS rolling shutter cameras

The way how the pixel integration and readout is handled by rolling shutter cameras (see Section 3.5.1.3, “CMOS: global vs. rolling shutter” [p. 37]) is significantly different from cameras featuring global shutter. Thus also the trigger modes implemented by rolling shutter cameras are different.

#### Snapshot mode

Default trigger mode for the rolling shutter cameras.

In the snapshot mode only the leading edge of the trigger pulse is significant. When encountered, first row of the sensor is reset and its exposure starts. With a small offset, the second row and gradually all other rows are reset and their exposure starts. When the last row is reset, a period when all row are exposing starts. The possible (recommended) strobe illumination should fall into this period. When the common exposure time (strobe period) ends, first line is read out, then the second line and all other lines until entire sensor is read out.

Exposure time (meaning the “strobe” period when all rows are integrating) can be programmed in a sensor specific rang.

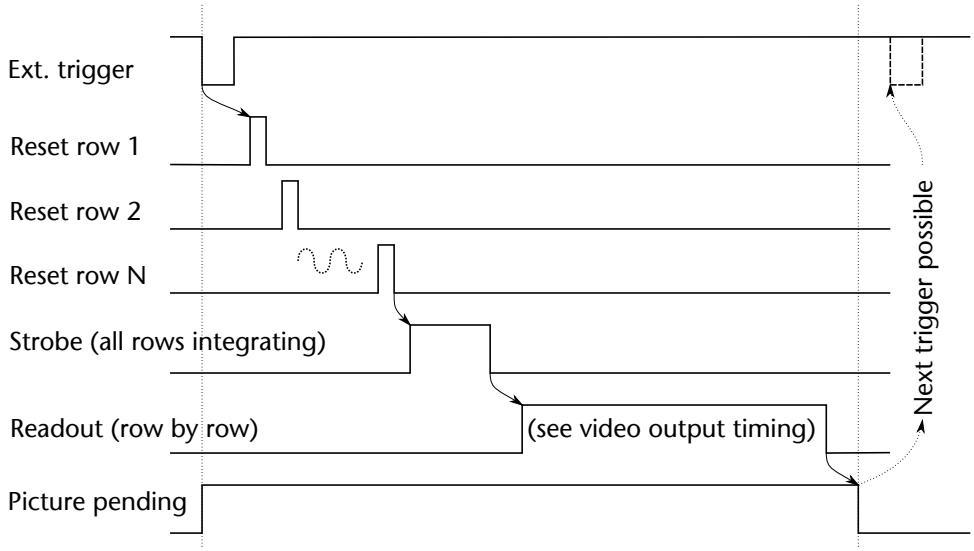


*Figure 6.19. Snapshot mode timing*

#### Global reset mode

Some rolling shutter sensors support additionally the global reset mode, which is very similar to the snapshot mode. The main difference is that all sensor rows are “globally” reset at the same time and the common integration time (strobe period) begins. After that, row-by-row sensor readout starts.

*Because in global reset mode all the image rows are reset at the same time, but the readout is performed gradually, row-by-row, as usual for rolling shutter sensors, the exposure time is actually different for every image row (shortest for the first, longest for the last row). Thus it is highly recommended to use this mode only with a strobe illumination falling into the common exposure time period.*

*The main advantage over the snapshot mode is that the global reset mode is significantly faster (with the snapshot mode you loose one frame time between the actual trigger and start of the strobe period).*

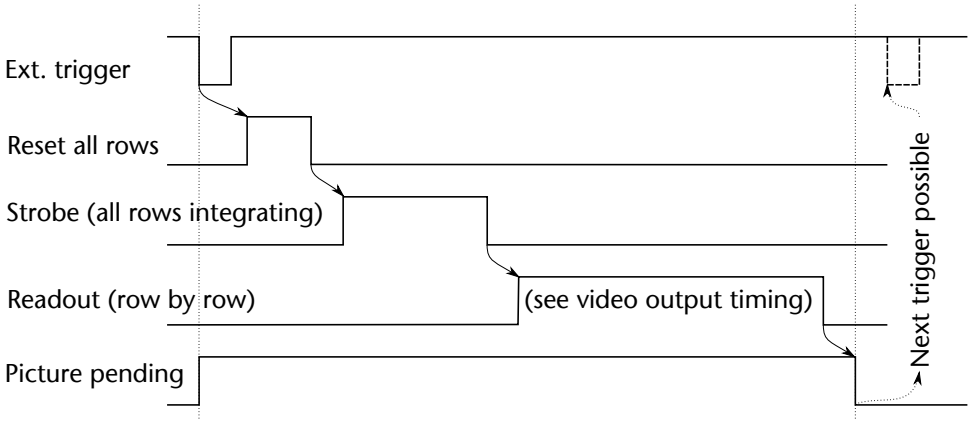


*Figure 6.20. Global reset mode timing*

## 6.6.4. Trigger configuration

When configuring the acquisition trigger, it's first necessary to select the trigger type to be configured. The camera currently supports just a single type (*Frame Start* trigger), but more trigger types will likely be added in future firmware versions. After switching the trigger on, the additional trigger options will become available. Note that the trigger configuration cannot be changed during acquisition.

Following steps document the procedure to configure the acquisition trigger:

1. **Select trigger type.** Use the *Trigger Selector* feature to select the trigger type to be configured. In current firmware version, only the *Frame Start* trigger is available. Each occurrence of this trigger starts acquisition of a new image frame.

2. **Switch the trigger on/off.** Set the *Trigger Mode* feature *On*/*Off*. When switched off, the camera operates in free running mode, no additional trigger parameters are available. When switched on, the camera operates in triggered mode and other trigger parameters can be configured.

3. **Specific trigger modes.** If a specific trigger mode should be used, switch on corresponding flag (*Long Range Exposure Mode* or *Global Reset Mode*).

4. **Trigger source (input line).** Configure the source of the trigger signals (*Trigger Source* feature). It can be a physical input line, such as *Line 1* (see Section 6.7, “Digital I/O, counters and timers” [p. 136], Section 3.7, “Input and output signals” [p. 39], Section 3.8, “Connector and cable description” [p. 44]). Alternatively, the trigger source can be set to *Software Trigger* — then the triggers are generated by the application, executing the command feature *Generate Software Trigger*. Note that while using a physical line as trigger source, the trigger can still be forced through the *Generate Software Trigger* command.

   Finally, the trigger source can be connected to one of the action commands, such as *Action 1*, if supported by the camera (see Section 6.8, “Action commands control” [p. 147]).

5. **Trigger activation (polarity).** The *Trigger Activation* feature controls which edge of the trigger input signal will be active, ie. which edge will actually ignite the trigger action. Possible values are *Rising Edge* and *Falling Edge*, rising edge being the transition of signal level from logical `0` to logical `1`. The interpretation of signal levels for different input types (TTL/opto-

coupler) is discussed in Section 3.7, “Input and output signals” [p. 39]. Not applicable for software triggering.

6. **Other options.** Eventually other fine-tuning options can be adjusted. Thes include:

   - *Trigger Delay* — delay in µs between the trigger and actual exposure start
   - *Trigger Divider* — allows to filter the trigger signals by a given ratio, only every Nth trigger is used
   - *Trigger Caching* — decides what to do, if a trigger arrives too early, before it can be accepted by the camera. Possible values are *Drop* (the trigger is ignored) and *Cache* (the trigger is applied as soon as the camera is ready).

7. **Triggering.** The triggers, being generated from external device using a trigger input line or from the application through the *Generate Software Trigger* command, can be issued as soon as the acquisition is started. Eventual physical triggers delivered when no acquisition is active will be ignored, the *Generate Software Trigger* command will not be executable.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure triggered mode
LvSetEnum (hDev, LvDevice_TriggerSelector, LvTriggerSelector_FrameStart);
LvSetEnum (hDev, LvDevice_TriggerMode, LvTriggerMode_On);
// optionally use a specific trigger mode, if supported
if (LvIsAvailable (hDev, LvDevice_LvLongRangeExposureMode))
{
    LvSetBool (hDev, LvDevice_LvLongRangeExposureMode, 1);
}
if (LvIsAvailable (hDev, LvDevice_LvGlobalResetMode))
{
    LvSetBool (hDev, LvDevice_LvGlobalResetMode, 1);
}
// configure hardware trigger input
LvSetEnum (hDev, LvDevice_TriggerSource,
                 LvTriggerSource_Line1); // opto input
LvSetEnum (hDev, LvDevice_TriggerActivation,
                 LvTriggerActivation_RisingEdge);
// configure software trigger input
LvSetEnum (hDev, LvDevice_TriggerSource, LvTriggerSource_Software);
// configure trigger over an action command
LvSetEnum (hDev, LvDevice_TriggerSource, LvTriggerSource_Action1);
// other options
LvSetFloat (hDev, LvDevice_TriggerDelay, 100.0); // 100 µs
LvSetEnum (hDev, LvDevice_LvTriggerCaching,
                 LvTriggerCaching_Cache); // or 'LvTriggerCaching_Drop'
// issue software trigger command after starting the acquisition
// - to generate regular trigger in software trigger mode
// - to force the trigger in hardware trigger mode
LvCmdExecute (hDev, LvDevice_TriggerSoftware);
// switch back to free-running mode
LvSetEnum (hDev, LvDevice_TriggerSelector, LvTriggerSelector_FrameStart);
LvSetEnum (hDev, LvDevice_TriggerMode, LvTriggerMode_Off);
```

GEN<i>CAM

```
// configure triggered mode
write_enum (TriggerSelector, FrameStart)
write_enum (TriggerMode, On)
// optionally use a specific trigger mode, if supported
write_enum (LvLongRangeExposureMode, true)
write_enum (LvGlobalResetMode, true)
// configure hardware trigger input
write_enum (TriggerSource, Line1) // opto input
write_enum (TriggerActivation, RisingEdge)
// configure software trigger input
write_enum (TriggerSource, Software)
// configure trigger over an action command
write_enum (TriggerSource, Action1)
// other options
write_float (TriggerDelay, 100.0) // 100 µs
write_enum (LvTriggerCaching, Cache) // or 'Drop'
// issue software trigger command after starting the acquisition
// - to generate regular trigger in software trigger mode
// - to force the trigger in hardware trigger mode
exec_cmd (TriggerSoftware)
// switch back to free-running mode
write_enum (TriggerSelector, FrameStart)
write_enum (TriggerMode, Off)
```

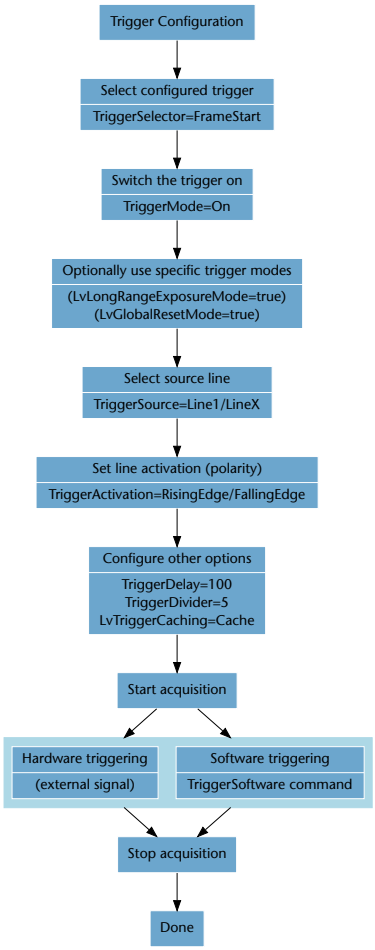


*Figure 6.21. Flow chart: trigger mode configuration*

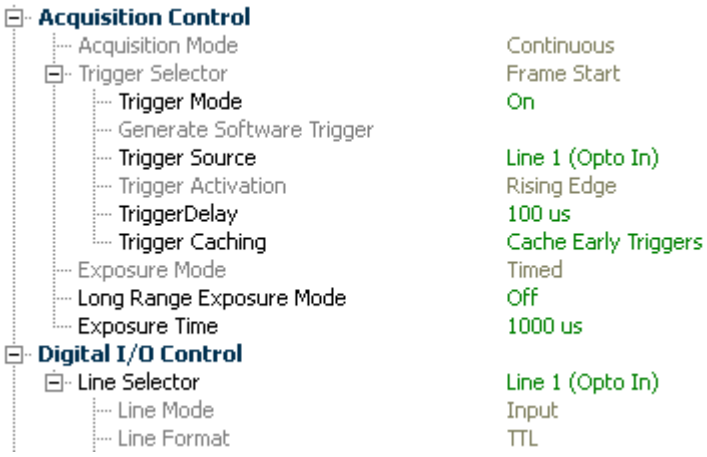


*Figure 6.22. Example trigger configuration: triggering over Line1 (optocoupler input), activation on rising edge, trigger delay 100 µs*

## 6.6.5. Frame rate

The frame rate (frequency of acquired image frames) of course varies among camera models, but it also depends on current settings, in particular:

- Pixel clock (sensor digitization clock)
- Area of interest (AOI, also known as “partial scan”)
- Binning/decimation

In triggered mode, the actual frame rate obviously depends on the frequency of incoming triggers, but it still cannot exceed the maximum defined by the current settings. The maximum achievable frame rate in triggered mode is lower than in the free running mode, because in free running mode the exposure of a new frame overlaps with readout of the previous one, while in the triggered mode the two operations are sequential (new trigger is not accepted while readout of the previous frame is still in progress).

When using the camera in the free-running mode (non-triggered), it is sometimes useful to decrease the frame rate from it's maximal value to a desired lower one. The reasons might be to moderate the processing load or network load when full frame rate is not needed.

To enable the frame rate settings, the *Acquisition Frame Rate Control* mode must be enabled first (switched to *On*). When set to this mode, the camera internally switches to triggered mode and generates periodic internal triggers with the desired frequency. The *Acquisition Frame Rate* feature itself is a floating point value in Hz.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure frame rate in Hz
// (available only when operation in non-triggered mode)
if (LvIsAvailable (hDev, LvDevice_LvAcquisitionFrameRateControlMode))
{
    LvSetEnum (hDev, LvDevice_LvAcquisitionFrameRateControlMode,
                     LvAcquisitionFrameRateControlMode_On);
    LvSetFloat (hDev, LvDevice_AcquisitionFrameRate, 20.0);
}
// switch back to regular free-running mode (max frame rate)
LvSetEnum (hDev, LvDevice_LvAcquisitionFrameRateControlMode,
                     LvAcquisitionFrameRateControlMode_Off);
```

GEN<i>CAM

```
// configure frame rate in Hz
// (available only when operation in non-triggered mode)
write_enum (LvAcquisitionFrameRateControlMode, On)
write_float (AcquisitionFrameRate, 20.0)
// switch back to regular free-running mode (max frame rate)
write_enum (LvAcquisitionFrameRateControlMode, Off)
```

*Since camera internally switches to triggered mode for frame rate control, the maximum achievable frame rate is lower than the native free-running mode rate (when frame rate control mode is off).*

*The frame rate feature can never increase the frequency beyond the maximum defined by current working mode (see above), it can only decrease it. To reach a higher frame rate, adjusting corresponding settings (such as AOI or pixel clock) should be considered.*

# 6.7. Digital I/O, counters and timers

This section discusses the digital I/O signal configuration.

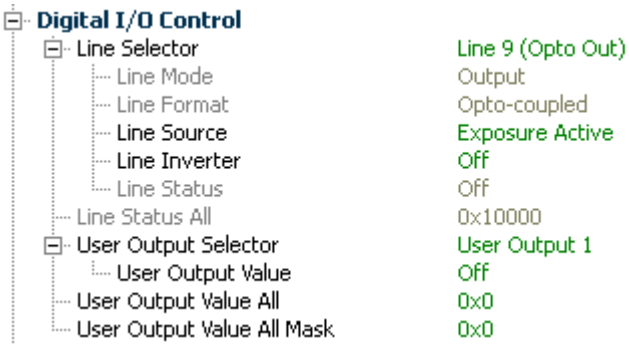


*Figure 6.23. Example GUI showing the digital I/O features*

*Figure 6.24. Example GUI showing the counters and timers features*

## 6.7.1. Camera I/O lines

The number and type of I/O lines might differ among camera models. The overview of the lines available and their assignment to actual physical pins on external connectors is given at Section 3.7, “Input and output signals” [p. 39] and Section 3.8, “Connector and cable description” [p. 44].

To query the information about camera's I/O lines, one may loop through the *Line Selector* feature and read the line mode (input/output) and format (optocoupler/TTL). In general, the interface

recognizes lines `Line1` through `Line32`, but only a subset of them might be implemented by a camera model.

The line mapping is fixed for all our camera families — all PicSight and CheckSight models (the legacy firmware versions 1.x of PicSight-GigE used different mapping). It's briefly summarized in the following table, details are listed in Section 3.7, “Input and output signals” [p. 39] and Section 3.8, “Connector and cable description” [p. 44].

| I/O lines | Mapped signals |
|---|---|
| `Line1`—`Line4` | Optocoupler inputs |
| `Line5`—`Line8` | Reserved |
| `Line9`—`Line12` | Optocoupler outputs |
| `Line13`—`Line16` | Reserved |
| `Line17`—`Line18` | TTL inputs |
| `Line19`—`Line24` | Reserved |
| `Line25`—`Line26` | TTL outputs |
| `Line27`—`Line32` | Reserved |

*Table 6.1. Overview of digital I/O line mapping*

Simplon

```
LvHDevice hDev; // open the device to get the handle
// query info about line 4
if (LvIsAvailableEnumEntry(hDev, LvDevice_LineSelector,
                                 LvLineSelector_Line4))
{
    LvSetEnum (hDev, LvDevice_LineSelector, LvLineSelector_Line4);
    int32_t EnumVal;
    // line mode gives LvLineMode_Output or LvLineMode_Input
    LvGetEnum (hDev, LvDevice_LineMode, &EnumVal);
    // line format gives LvLineFormat_OptoCoupled or LvLineFormat_TTL
    LvGetEnum (hDev, LvDevice_LineFormat, &EnumVal);
}
```

GEN<i>CAM

```
// query info about line 4
write_enum (LineSelector, Line4)
read_enum (LineMode) // Input or Output
read_enum (LineFormat) // OptoCoupled or TTL
```

### 6.7.1.1. Physical and logical lines

Except of the actual “physical” signals (representing the electrical status of the individual input/output lines, possibly inverted by the *Line Inverter* flag), few additional “logical” signals can also be used for configuration. These are virtual signals representing internal status of the camera. The available logical signals are:

- *Exposure Active* (`ExposureActive`) — the signal is asserted during an active exposure, both start and duration of the signal is aligned with the exposure
- *Frame Trigger* (`FrameTrigger`) — asserted, when a frame trigger is issued, no matter if issued by an external event, software command or other means. Only the starting edge of the signal

is significant, the duration is undefined. The signal is asserted immediately when the frame trigger arrives, before applying the *Trigger Delay*.
- *Timer X Active* (`TimerXActive`) — aligned with active period of a timer. The signal starts as soon as the *Timer Delay* expires and stays active during entire *Timer Duration*. Discussed below.
- *Counter X End* (`CounterXEnc`) — asserted when a counter expires (reaches *Counter Duration*). Only the starting edge is significant, duration of this signal is undefined. Discussed below.
- *User Output X* (`UserOutputX`) — asserted as long as given user output is set. Only the starting edge is significant, duration of this signal is undefined. Discussed below.

## 6.7.2. Observing I/O lines' status

There are two ways to query the current status of the camera's I/O lines:

- Status of the (single) line currently selected in the *Line Selector* is reported in the boolean feature *Line Status*. Note that the status of the output lines can be inverted using *Line Inverter* flag, as will be described shortly below. The way, how the signal levels of individual I/O types (TTL/optocoupler) are interpreted as logical `0` and `1` is described in Section 3.7, “Input and output signals” [p. 39].

- Status of all the I/O lines can be querying in a single access using *Line Status All* integer. This feature is a 32-bit bitfield each bit representing status of a single line. The least significant bit corresponds with *Line 1*, next bit with *Line 2* etc.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// read current status of line 2
LvSetEnum (hDev, LvDevice_LineSelector, LvLineSelector_Line2);
int32_t IntVal;
LvGetBool (hDev, LvDevice_LineStatus, &IntVal);
// read status of all lines as a bitfield in single access
LvGetInt32 (hDev, LvDevice_LineStatusAll, &IntVal);
```

GEN<i>CAM

```
// read current status of line 2
write_enum (LineSelector, Line2)
read_bool (LineStatus)
// read status of all lines as a bitfield in single access
read_int (LineStatusAll)
```

The status of I/O lines associated with individual acquired images can also be monitored through the chunk data, see Section 6.11, “Chunk data” [p. 168].

## 6.7.3. Using input lines for triggering

The signals issued on the input lines can be used for triggering the acquisition and other actions. The trigger input lines are not configured, however, through features in the Digital I/O category, but through features of the respective subsystem. Refer to

- *Trigger Source* feature in Section 6.6, “Acquisition and trigger control” [p. 124] to see how to configure acquisition trigger input line.
- *Special Purpose Trigger Source* feature in Section 6.15, “Special features” [p. 196].

## 6.7.4. Basic output (strobe) configuration

The most typical use case for digital output is possibly driving a strobe light. The simple case of strobe aligned with active exposure can be configured easily — select the desired line in *Line Selector* and set its *Line Source* to *Exposure Active* logical signal. If desired, the output signal polarity can be inverted.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure strobe output aligned withe exposure on line 10
// (remeber to configure triggered mode first)
LvSetEnum (hDev, LvDevice_LineSelector, LvLineSelector_Line10);
LvSetEnum (hDev, LvDevice_LineSource, LvLineSource_ExposureActive);
// optionally invert the output signal polarity
LvSetBool (hDev, LvDevice_LineInverter, 1);
```

GEN<i>CAM

```
// configure strobe output aligned withe exposure on line 10
// (remeber to configure triggered mode first)
write_enum (LineSelector, Line10)
write_enum (LineSource, ExposureActive)
// optionally invert the output signal polarity
write_bool (LineInverter, true)
```

*Figure 6.25. Simple strobe configuration (strobe aligned with exposure)*

It is possible to drive multiple output lines by the same (eg. *Exposure Active*) signal at the same time. To disconnect an output line again, you simply set its line source back to *Off*.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// disconnect the output signal on line 10
LvSetEnum (hDev, LvDevice_LineSelector, LvLineSelector_Line10);
LvSetEnum (hDev, LvDevice_LineSource, LvLineSource_Off);
```

GEN<i>CAM

```
// disconnect the output signal on line 10
write_enum (LineSelector, Line10)
write_enum (LineSource, Off)
```

*Figure 6.26. Output line disconnected*

## 6.7.5. User output configuration

As an alternative to the digital line output configuration synchronized with a cameras internal signals (such as “exposure active” signal described above), the status of the individual output lines can be directly controlled by user actions. This functionality is implemented by the “user output” features in the *Digital I/O Control* category.

To directly control status of an output line, select the line and set its *Line Source* to one of the user outputs, eg. *User Output 1*. Multiple lines can be driven by the same user output. Unlike with the *Exposure Active* signal, the user outputs ara always available, even in the free running mode.

Once the configuration is finished, the output can be driven by toggling value of the corresponding user output — select the connected output in *User Output Selector*, then set its value through the *User Output Value* boolean feature.

The *Line Inverter* functionality still applies as usual for lines controlled through user outputs.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure line output on line 10 to be based on user output 1
LvSetEnum (hDev, LvDevice_LineSelector, LvLineSelector_Line10);
LvSetEnum (hDev, LvDevice_LineSource, LvLineSource_UserOutput1);
// now toggle the line status through the user output value as needed
LvSetEnum (hDev, LvDevice_UserOutputSelector,
                 LvUserOutputSelector_UserOutput1);
LvSetBool (hDev, LvDevice_UserOutputValue, 1);
LvSetBool (hDev, LvDevice_UserOutputValue, 0);
```

GEN<i>CAM

```
// configure line output on line 10 to be based on user output 1
write_enum (LineSelector, Line10)
write_enum (LineSource, UserOutput1)
// now toggle the line status through the user output value as needed
write_enum (UserOutputSelector, UserOutput1)
write_bool (UserOutputValue, true)
write_bool (UserOutputValue, false)
```

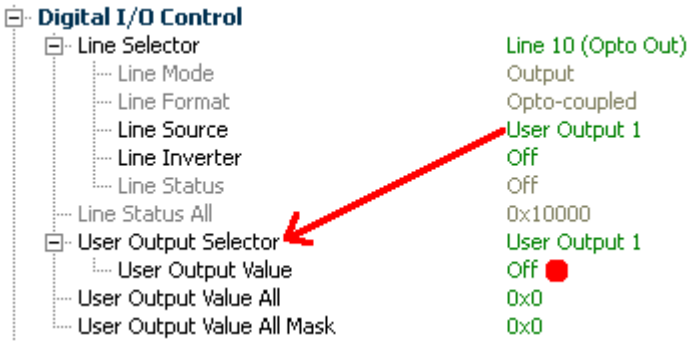


*Figure 6.27. Line output (strobe) controlled through the user output settings*

When working with multiple user outputs, it is possible to adjust them all in a single access. The camera provides two integer features, *User Output Value All* and *User Output Value All Mask*, both 32-bit bitfields. The least significant bit of the bitfields corresponds with *User Output 1*, the next bit with *User Output 2* etc.

The *User Output Value All Mask* bitfield defines the set of the user outputs to be adjusted, *User Output Value All* defines the logical values for them. When writing a new *User Output Value All* value, the camera considers only those user outputs being enabled (having "their" bit set) in the mask. The user outputs disabled in the mask (bit cleared) are preserved — their status is left intact, regardless the *User Output Value All* value.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// (connect line sources to user outputs as desired...)
// set the 'value-all-mask' to enable user output 1 and 2
LvSetInt32 (hDev, LvDevice_UserOutputValueAllMask, 0x3);
// following call sets just the enabled outputs to logical 1
// the other ones are left intact, keeping their current status
LvSetInt32 (hDev, LvDevice_UserOutputValueAll, 0xFF);
// next call sets output 1 to logical 1, outut 2 to logical 0
// the other ones are left intact, keeping their current status
LvSetInt32 (hDev, LvDevice_UserOutputValueAll, 0x1);
```

GEN<i>CAM

```
// (connect line sources to user outputs as desired...)
// set the 'value-all-mask' to enable user output 1 and 2
write_int (UserOutputValueAllMask, 0x3)
// following call sets just the enabled outputs to logical 1
// the other ones are left intact, keeping their current status
write_int (UserOutputValueAll, 0xFF)
// next call sets output 1 to logical 1, outut 2 to logical 0
// the other ones are left intact, keeping their current status
write_int (UserOutputValueAll, 0x1)
```

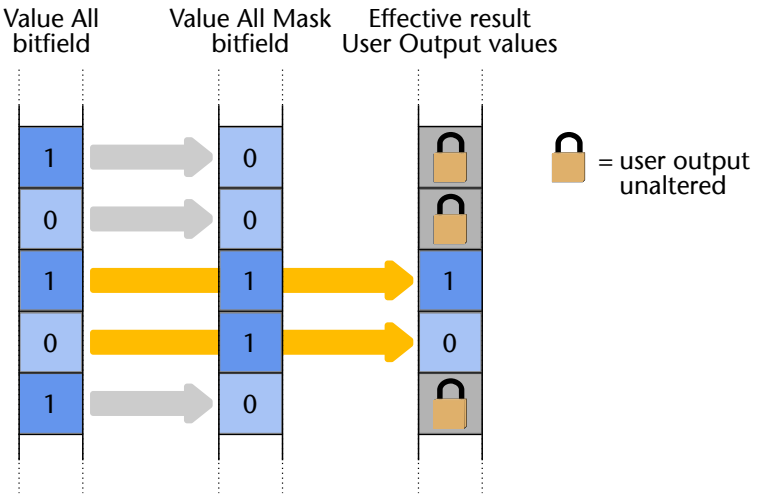


*Figure 6.28. User Output Value All functionality illustrated*

## 6.7.6. Advanced output configuration

Sometimes the digital output timing has to be different than the exposure timing. In such case, the output can be driven by a timer, started by the *Frame Trigger* event. The timer has a configurable *Timer Delay* and *Timer Duration* (both in µs). The delay defines, how long after receiving the frame acquisition trigger the camera asserts the output. The duration defines, how long stays the output active. The *Line Source* needs than be connected to such configured timer. To keep the description simple, let's describe the desired settings in source code and screenshot of finished configuration in Simplon Explorer.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure strobe output on line 10,
// starting 100 µs after frame trigger and staying active 1000 µs
// first configure the timer
LvSetEnum (hDev, LvDevice_TimerSelector, LvTimerSelector_Timer1);
LvSetEnum (hDev, LvDevice_TimerTriggerSource,
                 LvTimerTriggerSource_FrameTrigger);
LvSetFloat (hDev, LvDevice_TimerDelay, 100.0);
LvSetFloat (hDev, LvDevice_TimerDuration, 1000.0);
// now connect the line source to the configured timer
LvSetEnum (hDev, LvDevice_LineSelector, LvLineSelector_Line10);
LvSetEnum (hDev, LvDevice_LineSource, LvLineSource_Timer1Active);
// optionally invert the output signal polarity
LvSetBool (hDev, LvDevice_LineInverter, 1);
```

GEN<i>CAM

```
// configure strobe output on line 10,
// starting 100 µs after frame trigger and staying active 1000 µs
// first configure the timer
write_enum (TimerSelector, Timer1)
write_enum (TimerTriggerSource, FrameTrigger)
write_float (TimerDelay, 100.0)
write_float (TimerDuration, 1000.0)
// now connect the line source to the configured timer
write_enum (LineSelector, Line10)
```

```
write_enum (LineSource, Timer1Active)
// optionally invert the output signal polarity
write_bool (LineInverter, true)
```

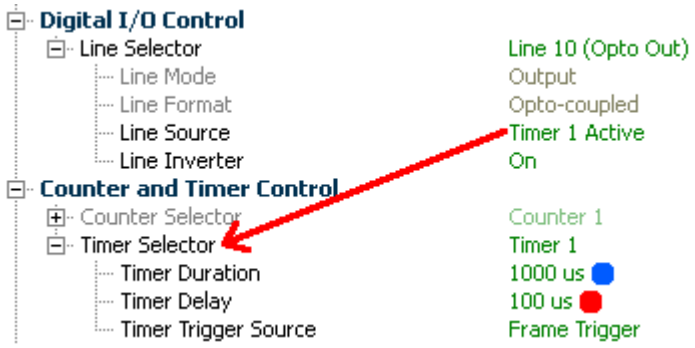


*Figure 6.29. Strobe configured to be delayed 100 µs behind trigger and last 1000 µs*

Note that any of the timers (*Timer 1* through *Timer 4*) could be used.

Using the described strobe timing configuration together with the *Trigger Delay* feature, the desired timing of the strobe and exposure itself can be precisely configured. Setting *Trigger Delay* larger than the strobe delay, the exposure starts later than the strobe signal itself.

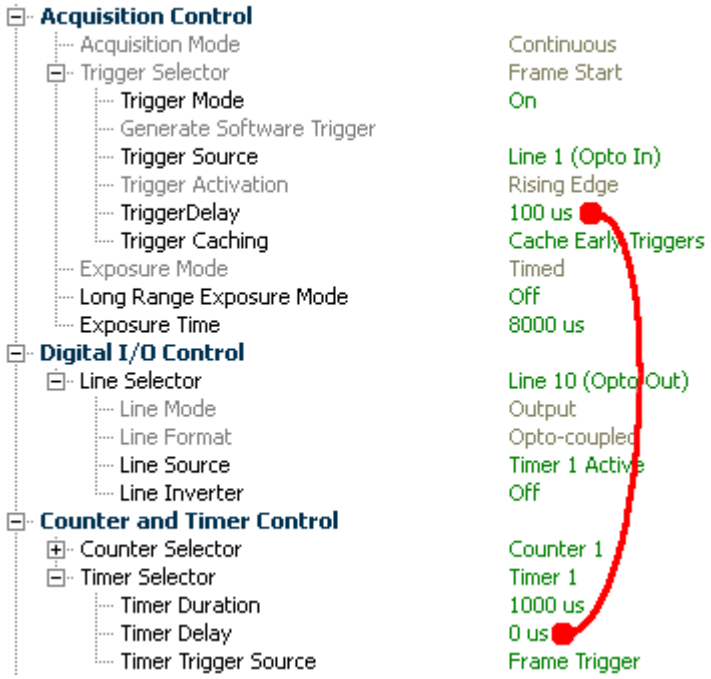


*Figure 6.30. Strobe configured to be start 100 µs before exposure start*

Sometimes it's desirable to assert the output just once in a number of events (frame triggers). This might be required in use cases such as inter-camera synchronization (see below) or similar. Such scenario is configured in the same way as the previous case (delayed output), just the timer is not connected directly to the frame trigger event, but through a counter. The timer (and any line output connected) would then be asserted only when the counter expires — the counter thus effectively behaves as signal divider. Let's have a look at the previous example modified to assert the output only at every fourth frame trigger event.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure strobe output on line 10,
// starting 100 µs after every 4th frame trigger
// and staying active 1000 µs
// first configure the counter
LvSetEnum (hDev, LvDevice_CounterSelector, LvCounterSelector_Counter1);
LvSetEnum (hDev, LvDevice_CounterEventSource,
                 LvCounterEventSource_FrameTrigger);
LvSetInt32 (hDev, LvDevice_CounterDuration, 4);
LvSetEnum (hDev, LvDevice_LvCounterMode,
                 LvCounterMode_Autoreset); // restarts when expired
// connect the timer and configure it
LvSetEnum (hDev, LvDevice_TimerSelector, LvTimerSelector_Timer1);
LvSetEnum (hDev, LvDevice_TimerTriggerSource,
                 LvTimerTriggerSource_Counter1End);
LvSetFloat (hDev, LvDevice_TimerDelay, 100.0);
LvSetFloat (hDev, LvDevice_TimerDuration, 1000.0);
// now connect the line source to the configured timer
LvSetEnum (hDev, LvDevice_LineSelector, LvLineSelector_Line10);
LvSetEnum (hDev, LvDevice_LineSource, LvLineSource_Timer1Active);
// optionally invert the output signal polarity
LvSetBool (hDev, LvDevice_LineInverter, 1);
```

GEN<i>CAM

```
// configure strobe output on line 10,
// starting 100 µs after every 4th frame trigger
// and staying active 1000 µs
// first configure the counter
write_enum (CounterSelector, Counter1)
write_enum (CounterEventSource, FrameTrigger)
write_int (CounterDuration, 4)
write_enum (CounterMode, Autoreset) // restarts when expired
// connect the timer and configure it
write_enum (TimerSelector, Timer1)
write_enum (TimerTriggerSource, Counter1End)
write_float (TimerDelay, 100.0)
write_float (TimerDuration, 1000.0)
// now connect the line source to the configured timer
write_enum (LineSelector, Line10)
write_enum (LineSource, Timer1Active)
// optionally invert the output signal polarity
write_bool (LineInverter, true)
```

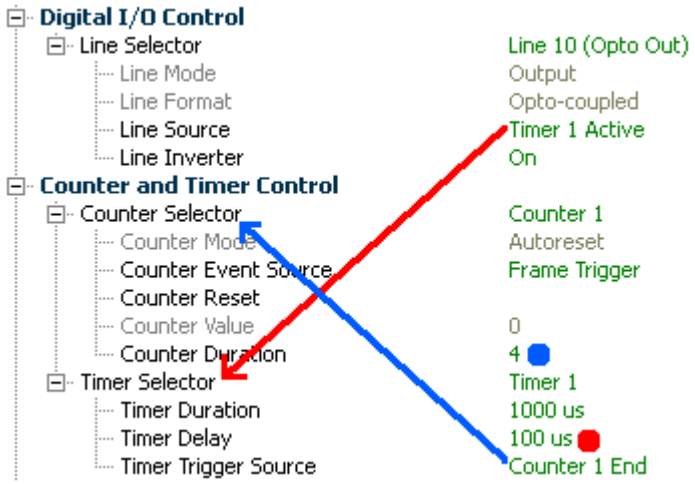


*Figure 6.31. Output configured to be fired on every fourth trigger (an delayed 100 µs)*

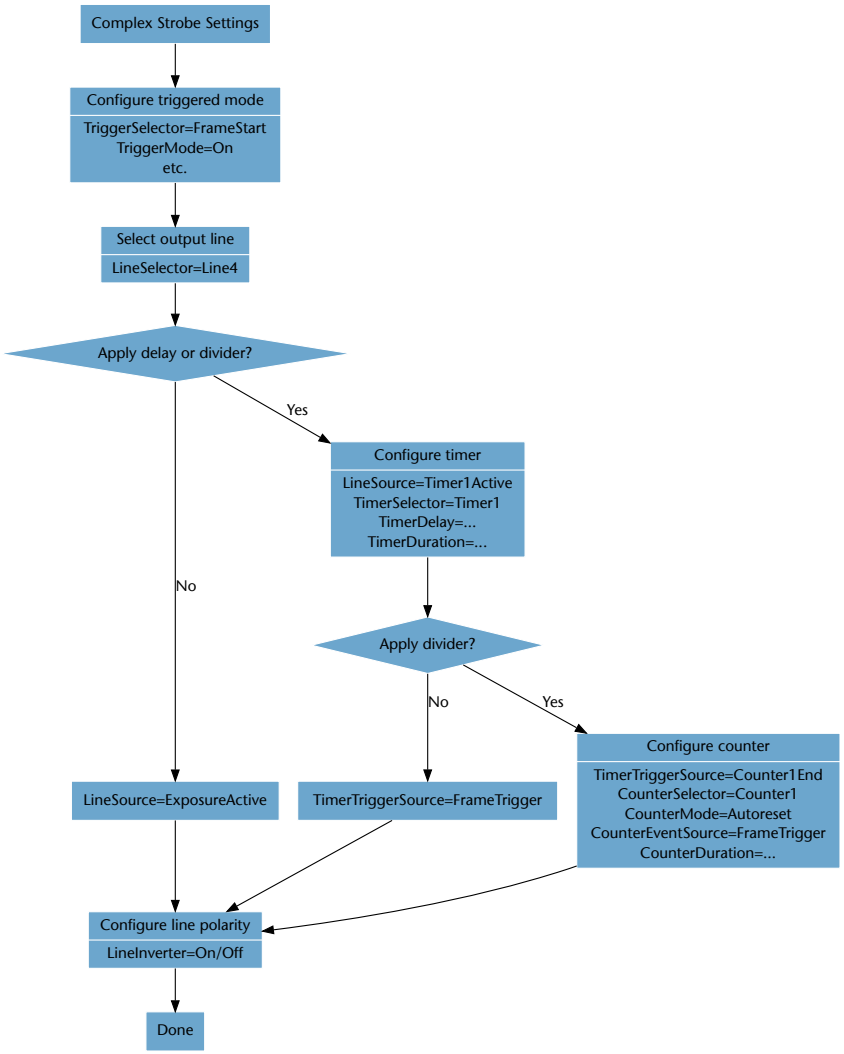


*Figure 6.32. Flow chart: strobe configuration options*

## 6.7.7. Disconnected outputs

When an output line is disconnected (its line source is set to *Off*), its status is always switched to its default (high impedance for optocoupler, driven high for TTL), regardless the actual value of the line inverter flag. Refer also to Section 3.7, “Input and output signals” [p. 39].

*The line might be effectively disconnected even if the line source is not Off, for example if the line source is set to Timer 1 Active, but the timer itself is disconnected (not driven by any signal).*

## 6.7.8. Use for inter-camera synchronization

One of possible use cases for the output signal “divider” described above is to synchronize frame ID's and timestamps across multiple cameras working together. If an application needs to pair images coming from multiple cameras, it needs to get them synchronized regularly. A possible solution to this problem is to output this synchronizing pulse once every “N” (eg. every 100) images are acquired on the master camera and route this signal to the timestamp-reset input on all involved cameras. The procedure to output a signal every Nth image was described above, the timestamp resetting triggers are discussed in Section 6.15, “Special features” [p. 196].

ACQ TRG: *acquisition trigger input*
TRG CPY: *output copying every Nth trigger*
RST TRG: *timestamp reset trigger input*

*Figure 6.33. Using digital I/O to periodically synchronize timestamps among multiple cameras*

## 6.7.9. Special topics

Just to make the discussion complete, we have to mention last few special timer/counter related features. First is the ability to software reset the counter at any time (using *Counter Reset* command, so that it starts counting again from zero. Second is the option to adjust counter's current *Counter Value* to any number lower than the counter duration.

Note that the counter value is only reset to zero when the counter expires or when calling the *Counter Reset* command explicitly. Connecting/disconnecting the *Counter Event Source* or starting/stopping acquisition has no influence on the counter value, which is maintained across these actions. The application should reset the counter value explicitly whenever needed.

```
LvHDevice hDev; // open the device to get the handle
// reset Counter1 (it will start counting from zero again)
LvSetEnum (hDev, LvDevice_CounterSelector, LvCounterSelector_Counter1);
LvCmdExecute (hDev, LvDevice_CounterReset);
// set counter value to duration-1
// first time it will expire at the very first event
// next time it will count the full 'duration' cycle
LvSetEnum (hDev, LvDevice_CounterSelector, LvCounterSelector_Counter1);
LvSetInt32 (hDev, LvDevice_CounterDuration, 100);
LvSetInt32 (hDev, LvDevice_CounterValue, 99);
```

GEN<i>CAM

```
// reset Counter1 (it will start counting from zero again)
write_enum (CounterSelector, Counter1)
exec_cmd (CounterReset)
// set counter value to duration-1
// first time it will expire at the very first event
// next time it will count the full 'duration' cycle
write_enum (CounterSelector, Counter1)
write_int (CounterDuration, 100)
write_int (CounterValue, 99)
```

# 6.8. Action commands control

This section discusses the features related to the control of action commands optionally delivered to the camera(s).

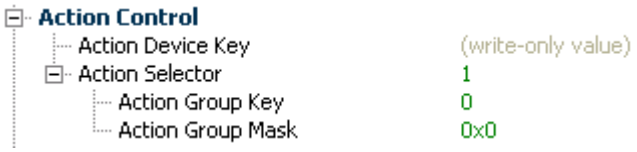


*Figure 6.34. Example GUI showing the action control features*

Action commands are intended to allow triggering various “actions” (typically a new frame acquisition) on multiple devices in parallel, in approximately same time. The commands are software generated “messages” delivered to the selected cameras through the Simplon GenTL Producer — or, in case of PicSight-GigE/PicSight-Smart from another GigE Vision compatible application with standard action command support. Note that because of their software nature (contrary to a hardware signal delivered over an I/O line), the action commands are not fully synchronous and may introduce certain jitter, dependent mainly on the actual system configuration.

The camera might recognize multiple different action commands. To find out the number of actions supported by the camera, read out the range of the *Action Selector* integer feature — it's minimum is always `1`, while the maximum corresponds with the number of recognized actions. When “connecting” to the individual actions, such as in *Trigger Source*, the actions are referred as *Action 1*, *Action 2*, etc.

Every action command generated by the application carries several parameters: “device key”, “group key” and “group mask”. The camera configuration contains corresponding matching features that are checked against the parameters carried by individual action commands delivered to the camera — to decide which (if any) actual action should be generated. This kind of fine grained matching is important, because the action commands are typically broadcast to all accessible devices. The camera's features controlling the action commands are:

*Action Device Key* — The action command will be only considered if the device is currently open by a controlling application and if the device key parameter included in the command equals the *Action Device Key* value configured in the device. If they do not match, the action command is immediately dropped without any further checks.

Note that the *Action Device Key* is a write-only 32-bit unsigned integer feature. It is write-only to ensure that the primary controlling application has full, exclusive control of the key. If the primary application desires to allow other applications (or even devices) to generate the action commands, it needs to pass the device key parameter to them.

*Action Selector* — Selects one of the action commands supported by the camera, allowing to configure the action-specific parameters, *Action Group Key* and *Action Group Mask*. The selector is an integer, ranging from `1` to the maximum number of action commands recognized by the camera. The value `1` corresponds the action being referred as *Action 1*, value `2` corresponds with *Action 2* etc.

*Action Group Key* — If an action command arrives and passes the device key check, it's group key parameter is compared against the *Action Group Key* values (again 32-bit unsigned integers) configured for the individual actions. Those actions for which their group keys equal with the key embedded in the command are considered as candidates for generating the actual action commands.

*Action Group Mask* — The *Action Group Mask* is the last step in the action command matching chain. For the action(s) matching the group key parameter, the delivered group mask parameter is compared against the actions configured *Action Group Mask* value (yet another 32-bit unsigned integer. In this case, the camera performs the bit-wise AND operation on the two values. If the result is nonzero, the action is considered as a “match” and the corresponding internal action signal is generated. Any subsystems connected to that action (for example the *Trigger Source*) would immediately receive the signal.

Given this algorithm for action command delivery, it is solely choice of the application, how it uses the described parameters to control a group of cameras through the action commands. Note that many applications control these parameters “under the hood” and that they are all accessible only in the “guru” feature visibility level.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// set the action device key parameter
// (using LvSetInt64() since the int32 range might  not
// be sufficient for the unsigned 32-bit parameters)
LvSetInt64 (hDev, LvDevice_ActionDeviceKey, 0x07A312B2);
// configure the group key and mas for Action 1
LvSetInt32 (hDev, LvDevice_ActionSelector, 1);
LvSetInt64 (hDev, LvDevice_ActionGroupKey, 0x00000020);
LvSetInt64 (hDev, LvDevice_ActionGroupMask, 0x00000013);
```

GEN<i>CAM

```
// set the action device key parameter
write_int (ActionDeviceKey, 0x07A312B2)
// configure the group key and mas for Action 1
```

```
write_int (ActionSelector, 1)
write_int (ActionGroupKey, 0x00000020)
write_int (ActionGroupMask, 0x00000013)
```

### 6.8.1. Using action commands for triggering

The action commands issued from the application can be used for triggering the acquisition and other actions. The respective actions used to trigger the desired operations are not configured, however, through features in the Action Control category, but through features of the respective subsystem. Refer to

- *Trigger Source* feature in Section 6.6, “Acquisition and trigger control” [p. 124] to see how to configure acquisition trigger action command.
- *Special Purpose Trigger Source* feature in Section 6.15, “Special features” [p. 196].

### 6.8.2. Generating the action commands

The information how to generate and deliver the action commands to the desired cameras is beyond the scope of this section. It is responsibility of the controlling application. If you are programming with Simplon, refer to its documentation (Chapter 7, *Simplon GenTL Producer features* [p. 248], Simplon programmer's guide). When programming with another GigE Vision compatible library, find the relevant information in its documentation.

## 6.9. Analog controls

This section discusses the “analog” features of the image, ie. the features that affect the analog to digital conversion of the sensor output.

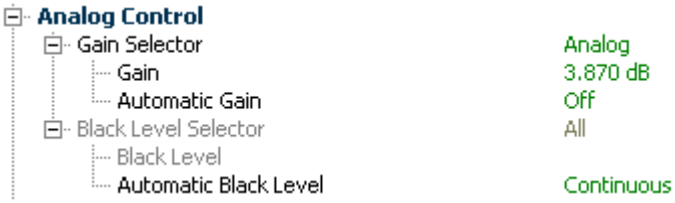


*Figure 6.35. Example GUI showing the analog controls' features*

### 6.9.1. Gain

Gain is a multiplicative factor applied to the pixel output values to increase the response — produce higher pixel values (higher brightness). It is useful when under given conditions (environment and maximal acceptable exposure time) the sensor does not reach the desired level of saturation. Note however, that together with the useful signal itself, gain amplifies also the noise, so it does not improve the real pixel dynamic range. It is therefore recommended when increasing the brightness, first adjust the exposure time (Section 6.6, “Acquisition and trigger control” [p. 124]) and only go for gain when exposure time can no more be increased. Another alternative to gain settings is, of course, adjusting the lens aperture, which can be automated on cameras supporting the lens control functionality (Section 6.14.3, “Lens control” [p. 187]).

There are two types of gain available (although not all camera modes support both of them):

| | |
|---|---|
| Analog gain | Amplifies the actual analog signal output of the sensor, before actually digitizing it. |
| Digital gain | Amplifies already digitized pixel values (multiplying by a given factor). Since certain noise is also generated during the A/D conversion, digital gain also amplifies this additional noise and is thus less accurate than the analog gain. |

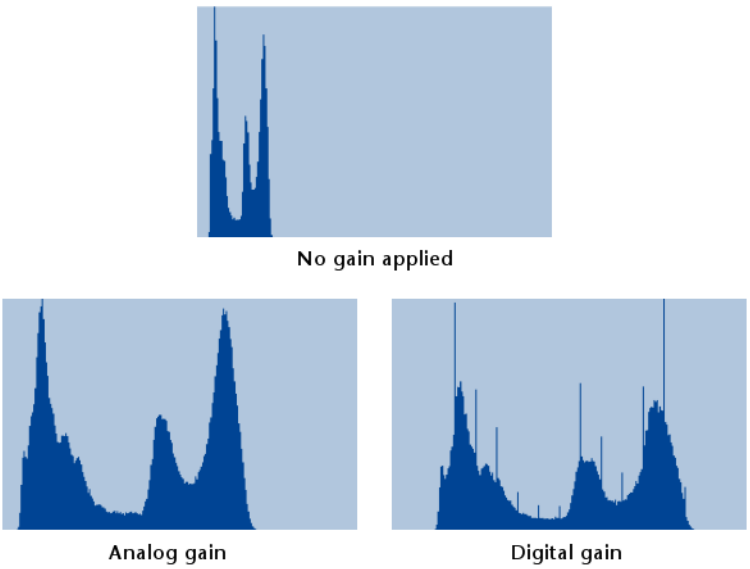


*Figure 6.36. Comparison of analog and digital gain, the histogram shows how digital gain amplifies the digitization noise*

Gain values are expressed in logarithmic unit, decibel (dB). Increasing the gain by 6 dB approximately doubles the camera response. To find correct gain value in dB for a desired pixel value multiplication factor, use formula: `Gain=20*log(MultiplicativeFactor)`.

The range of possible gain values is model specific, negative gain is also possible for certain models. The available range might differ in free running and individual triggered modes. Note that the camera might be able to adjust the gain only in small but discrete steps. It will align the requested value to the closest "step" — to know the exact used value, the application might want to re-read the gain after setting it.

All the camera models are adjusted, so that for gain set to 0 dB, the maximal sensor output (output of fully saturated sensor) produces the "white" pixels (pixel value 255 for 8-bit pixel format).

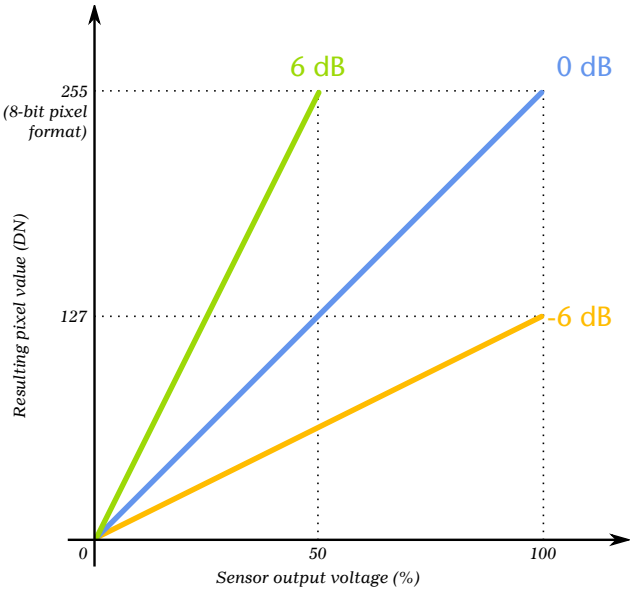


*Figure 6.37. Output pixel values for various gains (assumes that no black level is applied)*

*Figure 6.38. Gain effect example (±6 dB)*

Before reading/writing the *Gain* value, it is necessary to first select the gain type to be accessed in the *Gain Selector* enumeration. Possible values are *Analog* and *Digital* (although not all camera models support both of them).

Simplon

```
LvHDevice hDev; // open the device to get the handle
// adjust analog gain to 6 dB
// (assumes that it is not switched to automatic mode)
LvSetEnum (hDev, LvDevice_GainSelector, LvGainSelector_AnalogAll);
LvSetFloat (hDev, LvDevice_Gain, 6.0);
// if desired, re-read the value possibly adjusted by the camera
double FloatVal;
LvGetFloat (hDev, LvDev_Gain, &FloatVal);
// adjust digital gain (if available) to -6 dB
if (LvIsAvailableEnumEntry(hDev, LvDevice_GainSelector,
                                 LvGainSelector_DigitalAll))
{
    LvSetEnum (hDev, LvDevice_GainSelector, LvGainSelector_DigitalAll);
    LvSetFloat (hDev, LvDevice_Gain, -6.0);
}
```

GEN<i>CAM

```
// adjust analog gain to 6 dB
// (assumes that it is not switched to automatic mode)
write_enum (GainSelector, AnalogAll)
write_float (Gain, 6.0)
// adjust digital gain (if available) to -6 dB
```

```
write_enum (GainSelector, DigitalAll)
write_float (Gain, -6.0)
```

The camera might also adjust the gain automatically, see Section 6.9.3, “Automatic gain and black level” [p. 154].

*On certain camera models (in particular those based on the G43A sensor), the gain is applied with a delay of one frame.*

#### 6.9.1.1. Default gain and exposure time settings

The factory defaults for gain and exposure time are adjusted for good “first test” experience, ie. to provide reasonable image brightness in regular office conditions in a typical illumination level, assuming lens aperture size 2.8. We assume that the user will have to adjust the camera anyway for the target working environment.

The order of adjusting the default values is as follows:

1. First try to adjust the image brightness by altering the exposure time. Do not, however, increase the exposure time beyond the value which would start affecting the camera's frame rate.
2. If the image is still too dark at the maximal exposure time level, finish the adjustment by increasing also the analog gain.
3. The digital gain, if available, is always kept at 0 dB.

### 6.9.2. Black level

The black level function (also known as “offset”) controls the output value of the black pixels, ie. pixels not exposed to illumination. It controls it by applying offset (positive or negative) to the individual pixel values. That offset is expressed as a floating point value in unit “digital number”, DN. Black level value 5 DN means that values of all pixels will increase approximately by 5. The offset is actually applied to the analog sensor output signal, before the analog to digital conversion.

The black level function can be used to keep the camera response constant in changing environment conditions. For example, if the camera and the sensor heats up, the response of the sensor will slightly increase thanks to the thermally generated pixel output. Decreasing the black level value will compensate for that. It is usually desirable to keep the values of the “black” pixels slightly above zero, so that a possible decrease of their value can also be recognized and appropriately compensated.

The range of possible values is model specific. Positive and negative values are possible, as well as decimal values. Note however, that the camera might be able to adjust the black level only in small but discrete steps. It will align the requested value to the closest “step” — to know the exact used value, the application might want to re-read the black level after setting it.

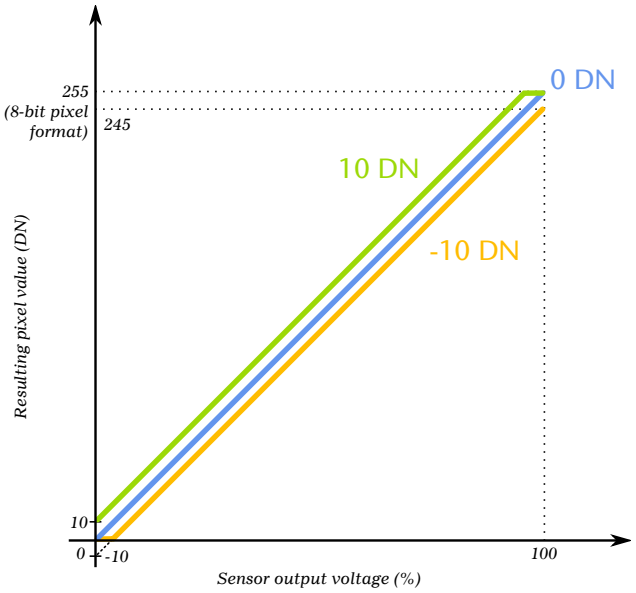


*Figure 6.39. Output pixel values for various black levels (assumes that no gain is applied)*

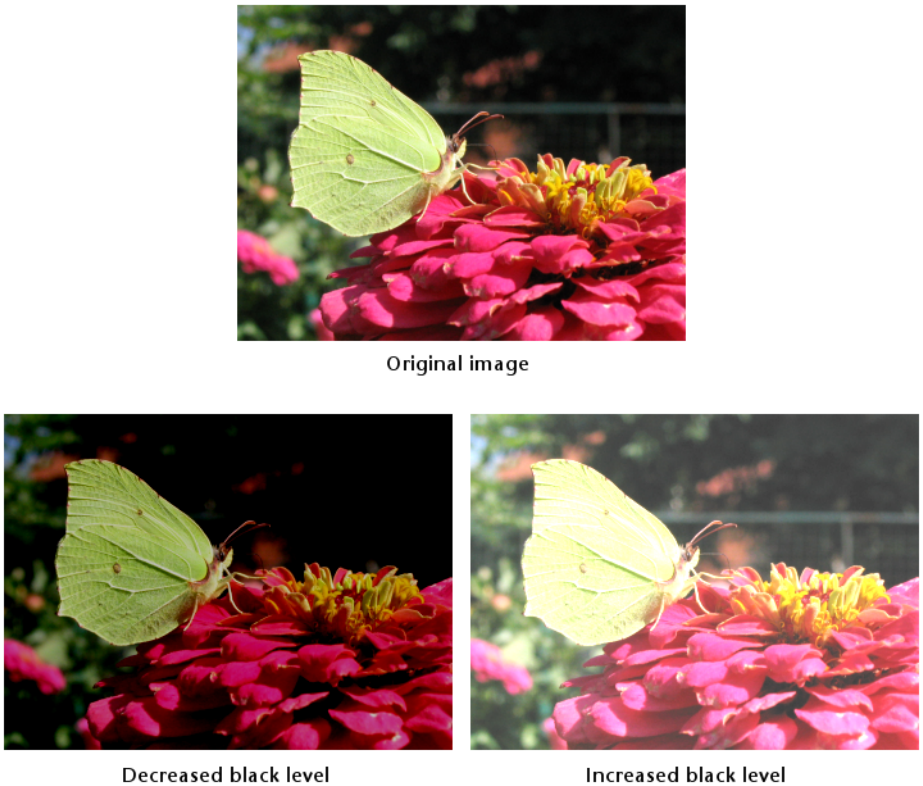


*Figure 6.40. Black level example (artificially increased effect)*

The function is controlled through the *Black Level* floating point feature. Since the cameras support just a single black level type, adjusting the *Black Level Selector* in the examples below is currently more less formal and could be omitted.

```
LvHDevice hDev; // open the device to get the handle
// adjust black level to 10.0 DN
// (assumes that black level is not switched to automatic mode)
LvSetEnum (hDev, LvDevice_BlackLevelSelector, LvBlackLevelSelector_All);
LvSetFloat (hDev, LvDevice_BlackLevel, 10.0);
```

GEN<i>CAM

```
// adjust black level to 10.0 DN
// (assumes that black level is not switched to automatic mode)
write_enum (BlackLevelSelector, All)
write_float (BlackLevel, 10.0)
```

Black level might also be adjusted automatically, see Section 6.9.3, “Automatic gain and black level” [p. 154].

#### 6.9.2.1. Black level and gain

When using together with gain, the black level is applied first. The sensor analog output is first adjusted according to the black level settings and the result is then subject to amplification by the selected gain factor. The effect may be symbolically expressed using an equation (of course considering that gain has in fact logarithmic effect):
`OutputValue = (InputValue+BlackLevel) * 10^(Gain/20)`, see also Section 6.9.1, “Gain” [p. 149].

#### 6.9.2.2. Black level and pixel format

Since the black level values are expressed in the “digital number” (DN) units, the same value can have different meaning for different pixel format. To reach the same effect, higher black level value is needed for pixel formats with more bits per pixel.

To give an example, a sensor pixel, which would give value 10 in 8-bit pixel format, would in 12-bit pixel format yield value around 160. Therefore also the black level value 10 DN in 8-bit pixel format has the same effect as 160 DN in 12-bit pixel format.

To keep the black level effect constant when changing the pixel format, the camera readjusts the black level range and the value itself whenever a pixel format is changed.

### 6.9.3. Automatic gain and black level

Similarly as automatic exposure (Section 6.6.2.1, “Automatic exposure” [p. 128]), selected camera models offer also automatic gain and automatic black level operation modes.

The automatic gain algorithm observes the luminance of acquired images and attempts to keep it at constant level, by compensating for any changes by adjusting the gain for subsequent frames. To prevent flickering, the adjustments are low-pass fltered — it may take several frames until the target luminance is restored again.

The automatic black level algorithm monitors the “dark pixels”, ie. the pixels out of the effective sensor area, which are not exposed to illumination. The value of the dark pixels is averaged over multiple acquired frames, low-pass filtered (to avoid fast oscillations) and compared to predefined thresholds. When the value falls outside those threshold, the black level is re-adjusted to restore the desired black values (very slightly above zero).

The configuration is analogical for all automatic features — each of them is controlled through an enumerated feature (*Automatic Gain*, *Automatic Black Level*, *Automatic Exposure*), which can switch between two modes, *Off* and *Continuous*. The *Off* option means the automatic mode is not active and given feature is controlled “manually” by adjusting the desired value. This is default

option for all the automatic features. The *Continuous* option means that the automatic adjustment of the feature is continuously applied.

To configure automatic gain, it is first necessary to select through *Gain Selector*, which gain type (analog or digital) is being configured.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// switch analog gain to automatic mode
// (full availability checking for generic applications)
if (LvIsAvailableEnumEntry(hDev, LvDevice_GainSelector,
                                 LvGainSelector_AnalogAll))
{
    LvSetEnum (hDev, LvDevice_GainSelector, LvGainSelector_AnalogAll);
    if (LvIsAvailableEnumEntry(hDev, LvDevice_GainAuto,
                                     LvGainAuto_Continuous))
    {
        LvSetEnum (hDev, LvDevice_GainAuto, LvGainAuto_Continuous);
    }
}
// switch digital gain to automatic mode
// (since now the extended checks omitted)
LvSetEnum (hDev, LvDevice_GainSelector, LvGainSelector_DigitalAll);
LvSetEnum (hDev, LvDevice_GainAuto, LvGainAuto_Continuous);
// switch to automatic black level mode
LvSetEnum (hDev, LvDevice_BlackLevelSelector, LvBlackLevelSelector_All);
LvSetEnum (hDev, LvDevice_BlackLevelAuto, LvBlackLevelAuto_Continuous);
// switch the analog gain back to manual mode,
// reading the newly adjusted value
LvSetEnum (hDev, LvDevice_GainSelector, LvGainSelector_AnalogAll);
LvSetEnum (hDev, LvDevice_GainAuto, LvGainAuto_Off);
double FloatVal;
LvGetFloat (hDev, LvDevice_Gain, &FloatVal);
```

GEN<i>CAM

```
// switch analog gain to automatic mode
write_enum (GainSelector, AnalogAll)
write_enum (GainAuto, Continuous)
// switch digital gain to automatic mode
write_enum (GainSelector, DigitalAll)
write_enum (GainAuto, Continuous)
// switch to automatic black level mode
write_enum (BlackLevelSelector, All)
write_enum (BlackLevelAuto, Continuous)
// switch the analog gain back to manual mode,
// reading the newly adjusted value
write_enum (GainSelector, AnalogAll)
write_enum (GainAuto, Off)
read_float (Gain)
```

*When using automatic gain together with the automatic exposure feature (Section 6.6.2.1, “Automatic exposure” [p. 128]), the auto exposure takes precedence. Automatic gain is inactive as long as the automatic exposure functionality does not reach its limits — only then the automatic gain becomes active as well.*

*The automatic gain functionality might work against the manual exposure time settings. When increasing the exposure time, the automatic gain function will decrease the gain to reach again the target luminance level.*

*The low pass filter applied in the automatic gain algorithm can cause, that the automatic gain value never fully reaches the limits (min/max) of the manual gain settings.*

# 6.10. Luminance and color handling

The section discusses camera features controlling the luminance and color information in the digitized image. The features include in particular the look-up table (LUT) and color transformation matrix, but the section discusses also several "higher level" functions that can be implemented using those primitives — for example gamma correction, binarization or white balance.

## 6.10.1. Look-up table (LUT)

The LUT (look-up table) is a trivial preprocessing technique allowing to map each input pixel value to a corresponding output pixel value. The look-up table operation is applied separately to every image pixel. The PicSight and CheckSight cameras use two types of LUTs, depending on the currently used pixel format (Section 6.5, "Image format" [p. 107]):

RGB LUT — Used only with the RGB/BGR pixel formats. The LUT consists of three tables, each controlling separately given color channel.

Luminance LUT — Used for all other pixel formats, ie. the monochrome and Bayer encoded ones. A single look-up table controls the luminance (gray value) of individual pixels.

When controlling the LUT, you first need to select the table you want adjust (luminance, red, green or blue) in the *LUT Selector* enumeration. The choice depends on the camera model and current pixel format. Having the table selected, you can loop through the entire range of *LUT Index* and adjust the *LUT Value* for each of them — we'll demonstrate that in a sample code below. Finally, the LUT operation can be switched on or off using the *LUT Enable* flag — when switched off, the data flow bypasses the LUT operation, but the LUT contents itself remains intact, so it is possible to switch it on again later, without need to refill the table.

The luminance LUT can be used to perform various operations, such as

- invert the image
- binarize the image at given threshold
- apply gamma correction
- adapt brightness and contrast
- simulate gain and black level operations
- etc.

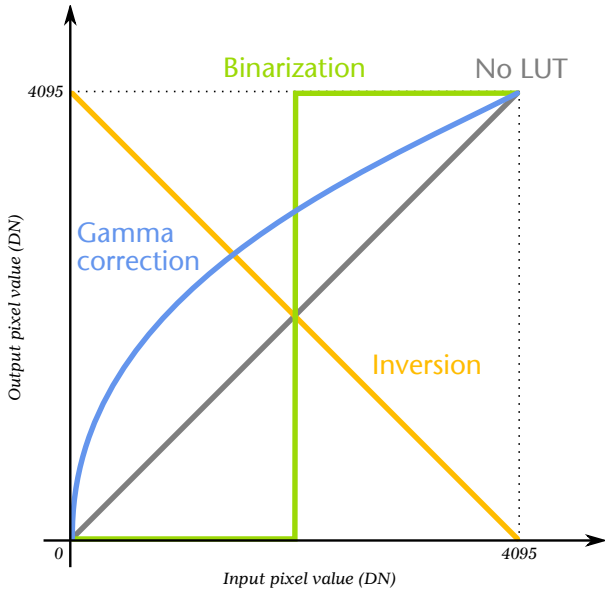


*Figure 6.41. Examples of functions implemented through luminance LUT*

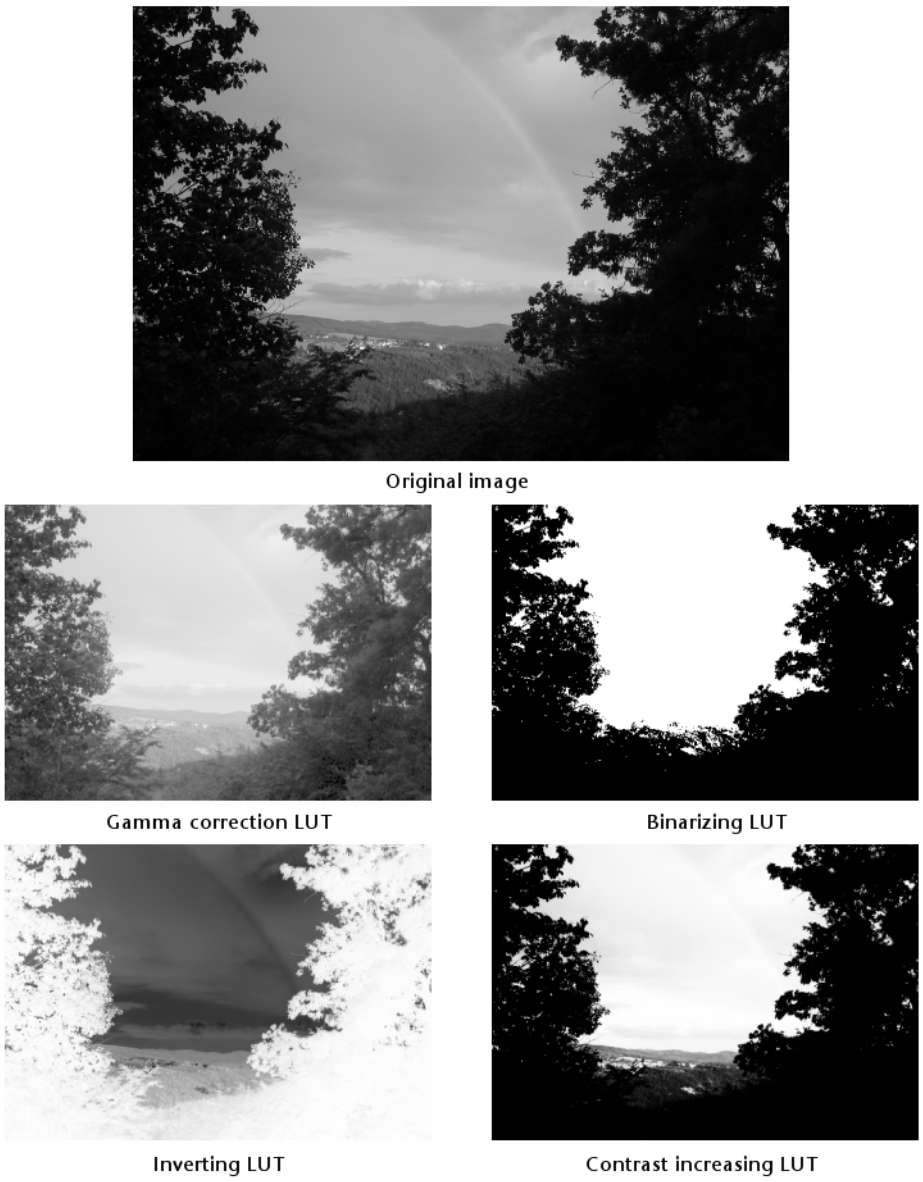


*Figure 6.42. Luminiance LUT function effects illustrated*

The camera internally always work with the image data read out from the sensor in 12-bit format, regardless the target format transferred to the host application. The luminance LUT thus always uses 12-bit depth at both input and output — meaning that the luminance LUT has always 4096 entries (index 0—4095) and each LUT value has also range of 0—4095, 0 corresponding with black, 4095 with white pixel.

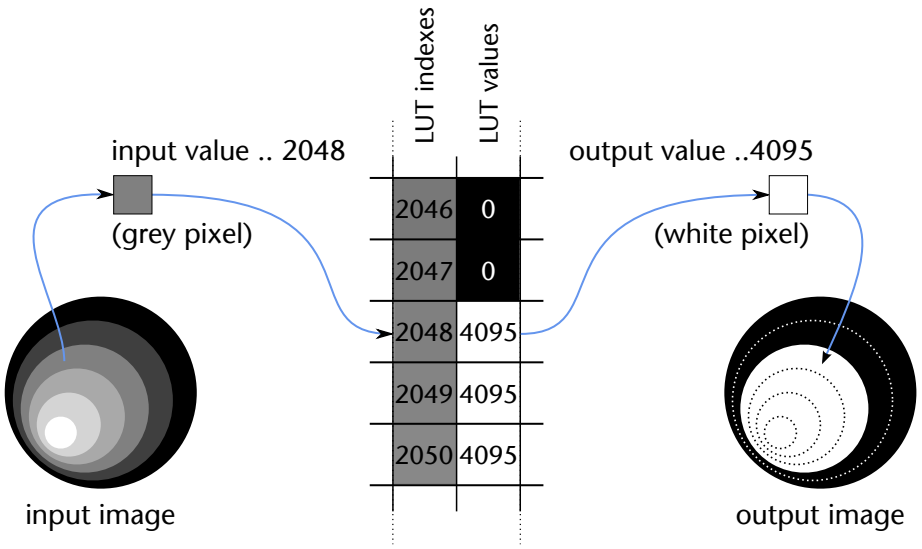


*Figure 6.43. 12-bit luminance LUT used as a binarization function*

Simplon

```
LvHDevice hDev; // open the device to get the handle
// adjust the luminance LUT...
LvSetEnum (hDev, LvDevice_LUTSelector, LvLUTSelector_Luminance);
// ...to invert the image
for (int i = 0; i<4095; ++i)
{
    LvSetInt32 (hDev, LvDevice_LUTIndex, i);
    LvSetInt32 (hDev, LvDevice_LUTValue, 4095-i);
}
// ...or to binarize the image at threshold 2048 (50% gray)
for (int i = 0; i<4095; ++i)
{
    LvSetInt32 (hDev, LvDevice_LUTIndex, i);
    LvSetInt32 (hDev, LvDevice_LUTValue, (i<2048) ? 0 : 4095);
}
// don't forget to enable the LUT
LvSetBool (hDev, LvDevice_LUTEnable, 1);
// disable the LUT later if needed (LUT contents will be preserved)
LvSetBool (hDev, LvDevice_LUTEnable, 0);
```

GEN<i>CAM

```
// adjust the luminance LUT...
write_enum (LUTSelector, Luminance)
// ...to invert the image
for (i = 0 .. 4095)
{
    write_int (LUTIndex, i)
    write_int (LUTValue, 4095-i)
}
// ...or to binarize the image at threshold 2048 (50% gray)
for (i = 0 .. 4095)
{
    write_int (LUTIndex, i)
```

```
    write_int (LUTValue, (i<2048) ? 0 : 4095)
}
// don't forget to enable the LUT
write_bool (LUTEnable, true)
// disable the LUT later if needed (LUT contents will be preserved)
write_bool (LUTEnable, false)
```

The RGB LUT works in principle same as the luminance LUT, it only consists from three separate tables, each controlling separately given color channel. It can accomplish the same operations as the luminance LUT — modifying all three tables in the same way. It can adapt the color information in the image — adjusting all the tables separately. A typical use case is the white balance adjustment, when individual channel responses are increased or decreased to balance the colors. Both approaches may be of course combined, eg. to perform white balance and gamma correction at the same time.

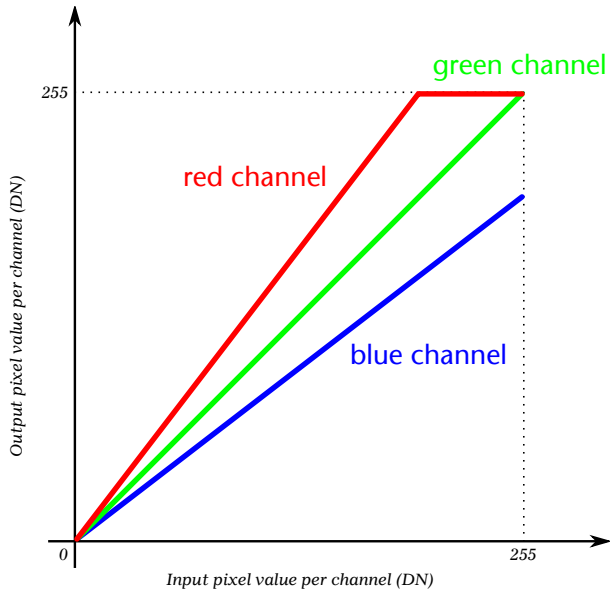


*Figure 6.44. Examples of an RGB LUT used for white balancing (increased red, decreased blue channel values)*

Original image

After reducing the blue channel through RGB LUT

*Figure 6.45. RGB LUT effect illustrated — blue channel reduced for simple white balancing*

The RGB LUT is used only with true color (RGB/BGR) pixel formats, after the Bayer decoding operation, when the camera converts the image to the 3×8-bit color format. The RGB LUT thus always uses 8-bit depth at both input and output — meaning that each of the three (R-G-B) tables has always 256 entries (index 0—255) and each LUT value has also range of 0—255, 255 corresponding with fully saturated color channel of the pixel.

Note that enabling/disabling any of the three red/green/blue LUT tables actually enables/disables the entire RGB LUT. It is not possible to enable them separately.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// adjust the RGB LUT for white balancing
// increase red, decrease blue, leave green channel intact
LvSetEnum (hDev, LvDevice_LUTSelector, LvLUTSelector_Red);
for (int i = 0; i<255; ++i)
{
    LvSetInt32 (hDev, LvDevice_LUTIndex, i);
```

```
    LvSetInt32 (hDev, LvDevice_LUTValue, 1.2*i);
}
LvSetEnum (hDev, LvDevice_LUTSelector, LvLUTSelector_Blue);
for (int i = 0; i<255; ++i)
{
    LvSetInt32 (hDev, LvDevice_LUTIndex, i);
    LvSetInt32 (hDev, LvDevice_LUTValue, 0.8*i);
}
LvSetEnum (hDev, LvDevice_LUTSelector, LvLUTSelector_Green);
for (int i = 0; i<255; ++i)
{
    LvSetInt32 (hDev, LvDevice_LUTIndex, i);
    LvSetInt32 (hDev, LvDevice_LUTValue, i);
}
// don't forget to enable the LUT
// (enabling any of the three tables enables entire LUT)
LvSetBool (hDev, LvDevice_LUTEnable, 1);
// disable the LUT later if needed (LUT contents will be preserved)
LvSetBool (hDev, LvDevice_LUTEnable, 0);
```

GEN<i>CAM

```
// adjust the RGB LUT for white balancing
// increase red, decrease blue, leave green channel intact
write_enum (LUTSelector, Red)
for (i = 0 .. 255)
{
    write_int (LUTIndex, i)
    write_int (LUTValue, 1.2*i)
}
write_enum (LUTSelector, Blue)
for (i = 0 .. 255)
{
    write_int (LUTIndex, i)
    write_int (LUTValue, 0.8*i)
}
write_enum (LUTSelector, Green)
for (i = 0 .. 255)
{
    write_int (LUTIndex, i)
    write_int (LUTValue, i)
}
// don't forget to enable the LUT
// (enabling any of the three tables enables entire LUT)
write_bool (LUTEnable, true)
// disable the LUT later if needed (LUT contents will be preserved)
write_bool (LUTEnable, false)
```

#### 6.10.1.1. LUT single access reading/writing

The per-element LUT access provides a natural interface for reading/writing the LUT, the application does not need to make any assumptions about the internal layout of the LUT. On the other hand, reading/wriging the entire LUT this way can generate significant overhead due to excessive I/O operations. In some situations, it might be desirable to eliminate this overhead, reading or writing the entire LUT in a single access.

The single-step access is performed through feature *LUT Value All*, which is based on GenICam type `IRegister`, behaving as a raw block of memory. All the rules about selecting the LUT to be accessed (*LUT Selector*) or enabling the LUT (*LUT Enable*) apply same as in case of the per-element access method, the feature *LUT Value All* just allows to replace the *LUT Index* and *LUT Value* calls with a single input/output request.

Since the *LUT Value All* feature accesses the LUT in a single step as a block of memory, it is necessary to know the internal layout of the LUT:

- Regardless of the LUT type, the size of the individual elements, as they are stored in the memory, are always 4 bytes. Naturally, not all bits of the 4-byte slot are actually used, the luminance LUT uses 12-bit, the RGB LUT's 8-bit elements. When writing the LUT as a memory block, the application is responsible to not overflow these limits.
- Beware, due to differences between the actual technologies, the endianess of the individual elements vary among Leutron Vision camera families. PicSight-GigE cameras store the LUT elements in big endian, CheckSight cameras in little endian format. The application is responsible to provide the memory block in correct format when writing. Note that these considerations apply only to the “entire memory block” access, when accessing the LUT per-element the LUT internals are shielded from the user.
- The number of elements in the LUT depends on the LUT type. As described above, the luminance LUT has always 4096 elements, while the individual R/G/B LUT's have 256 elements each.
- The entire size of the LUT in bytes is naturally product of the single element size (4B) and number of entries.
- The order of elements in the LUT is defined by their indexes. The element with index `0` is always stored at the lowest address (aligned with the start of the LUT memory block). The element with index `1` can be accessed at a 4-byte offset from the LUT beginning, etc.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// adjust the luminance LUT...
LvSetEnum (hDev, LvDevice_LUTSelector, LvLUTSelector_Luminance);
uint8_t LUTData[16384]; // 4096 * 4B
// prepare the memory block LUTData, using size and layout
// compatible with camera's internal representation of the LUT
LvSetBuffer(hDev, LvDevice_LUTValueAll, LUTData, 16384);
// don't forget to enable the LUT
LvSetBool (hDev, LvDevice_LUTEnable, 1);
```

GEN<i>CAM

```
// adjust the luminance LUT...
write_enum (LUTSelector, Luminance)
// prepare the memory block LUTData, using size and layout
// compatible with camera's internal representation of the LUT
write_raw_reg (LUTValueAll, LUTData, 16384)
// don't forget to enable the LUT
write_bool (LUTEnable, true)
```

### 6.10.1.2. Direct and indirect LUT control (LUT modes)

The LUT(s) can be configured either directly by adjusting the look-up table entries — or, if given camera supports it, through higher level functions built on top of the LUT functionality. An example of the higher level function is white balance, which is implemented on top of the RGB LUT.

The higher level function(s) fully control the LUT, in such case it's no more possible to modify the LUT entries directly. Therefore the user has to select the desired mode of operation. If a given camera supports various LUT operation modes, they are controlled through enumeration feature *LUT Mode*.

The basic, always available, option is *Direct*. In this case the LUT entries are controlled directly by the application. The higher level functions are not available.

Alternatively, it's possible to select a higher level function (e.g. *White Balance*). In that case, the features controlling given higher level function become available and take over the LUT control. LUT itself is still available, but in read-only mode. Individual higher level functions are discussed in separate sections.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// select the direct LUT control mode...
LvSetEnum (hDev, LvDevice_LvLUTMode, LvLUTMode_Direct);
// ...access the LUT entries directly now
// select a higher level function, here white balance
LvSetEnum (hDev, LvDevice_LvLUTMode, LvLUTMode_BalanceWhite);
// ...now LUT itself is read-only, controlled indirectly
```

GEN<i>CAM

```
// select the direct LUT control mode...
write_enum (LvLUTMode, Direct)
// ...access the LUT entries directly now
// select a higher level function, here white balance
write_enum (LvLUTMode, BalanceWhite)
// ...now LUT itself is read-only, controlled indirectly
```

### 6.10.1.3. White balance

White balance function is adjustment of intensities of individual color (R-G-B) channels to compensate for the unwanted color shift, e.g. because of non-neutral ambient illumination of the scene. The white balancing is controlled through amplification factors to be applied on the individual R-G-B color channels. Note that white balance makes only sense when using a true RGB pixel format.

The camera implements the white balance functionality using the RGB LUT — the white balance factors (“ratios”) are applied as linear functions in the individual R-G-B LUT's. To make the white balance functinality avilable (if supported by the camera), first switch *LUT Mode* to *White Balance*.

To apply the desired white balance factors, select progressively the individual color channels (*Red*, *Green*, *Blue*) in the *Balance Ratio Selector* enumeration and for each channel configure the desired amplification factor through *Balance Ratio*. The *Balance Ratio* is a floating point factor allowing to amplify the given color channel within certain limits.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// select the "white balance" LUT mode
LvSetEnum (hDev, LvDevice_LvLUTMode, LvLUTMode_BalanceWhite);
// adjust white balance:
// increase red, decrease blue, leave green channel intact
LvSetEnum (hDev, LvDevice_BalanceRatioSelector,
                 LvBalanceRatioSelector_Red);
LvSetFloat (hDev, LvDevice_BalanceRatio, 1.2);
LvSetEnum (hDev, LvDevice_BalanceRatioSelector,
                 LvBalanceRatioSelector_Green);
LvSetFloat (hDev, LvDevice_BalanceRatio, 1.0);
LvSetEnum (hDev, LvDevice_BalanceRatioSelector,
                 LvBalanceRatioSelector_Blue);
LvSetFloat (hDev, LvDevice_BalanceRatio, 0.8);
```

GEN<i>CAM

```
select the "white balance" LUT mode
write_enum (LvLUTMode, BalanceWhite)
write_enum (BalanceRatioSelector, Red)
write_float (BalanceRatio, 1.2)
write_enum (BalanceRatioSelector, Green)
write_float (BalanceRatio, 1.0)
write_enum (BalanceRatioSelector, Blue)
write_float (BalanceRatio, 0.8)
```

Besides the “manual” setting of the white balancing ratios, the camera might compute them automatically based on an actually acquired image. To instruct the camera to compute the new ratios, switch the *Automatic White Balance* feature to *Once* (the default value of this enumeration is *Off*). As soon as switched to *Once*, the camera will automatically evaluate the acquired image and compute new white balancing factor — considering, that the acquired image is color neutral, i.e. suitable for white balance calibration. When computed, the *Automatic White Balance* will switch back to *Off* and the newly computed values will be available through *Balance Ratio Selector*/*Balance Ratio*. Of course, the new values will immediately become effective. When required, the process should be repeated again.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// select the "white balance" LUT mode
LvSetEnum (hDev, LvDevice_LvLUTMode, LvLUTMode_BalanceWhite);
// trigger computation of new white balance factors
LvSetEnum (hDev, LvDevice_BalanceWhiteAuto,
                 LvBalanceWhiteAuto_Once);
// when finished, it switches back to LvBalanceWhiteAuto_Off
// and new balance ratios are immediately applied
```

GEN<i>CAM

```
select the "white balance" LUT mode
write_enum (LvLUTMode, BalanceWhite)
// trigger computation of new white balance factors
write_enum (BalanceWhiteAuto, Once)
// when finished, it switches back to LvBalanceWhiteAuto_Off
// and new balance ratios are immediately applied
```

Note, that computation of the white balancing factors based on the acquired image can be done even if the output pixelf format is not true RGB, but a Bayer encoded format. In such case the camera does not apply them directly (no RGB LUT with Bayer encoded pixel format), it just provides the recommended values (read-only) as a hint for the application, which can apply them after decoding the Bayer encoded image.

## 6.10.2. Color transformation

The color transformation functionality allows to adjust the color information through applying a matrix operation on every single pixel. The operation is applicable only for true color RGB/BGR output pixel formats (Section 6.5, “Image format” [p. 107]) since it takes the R-G-B channel values of each pixel as input.

The color transformation functionality can be used to perform various operations, such as

- image color improvement/correction, advanced white balancing, channel overlap elimination
- color to grayscale conversion
- format conversion (eg. RGB to YUV)
- adjusting color saturation
- adjusting brightness and contrast of color images
- hue rotation
- etc.

The color transformation functionality might be only available on specific camera models. Please contact Leutron Vision to check availability of the feature and its detailed documentation for given model.

*Figure 6.46. Artificial example illustrating the color transformation (in this case full color space rotation)*

## 6.10.3. Gamma correction, brightness and contrast

Simplon API provides several utility functions helping to implement some common image conditioning operations using the camera's LUT functionality. It can, for example, configure the LUT to apply desired gamma correction, optionally combined with brightness and contrast adjustment. Simplon API would automatically find out the currently active LUT type (luminance or RGB LUT), compute the LUT values based on the required inputs and adjust the LUT. The details are documented in Simplon programmer's guide.

## 6.10.4. White balance

The color interpretation in the acquired image might not always exactly correspond with the reality, for example because of non-neutral ambient illumination in the scene — some color components might be emphasized more than others. The goal of the white balancing operation

is to adjust the image colors so that color neutral objects (white or gray) are represented as such in the acquired image data. This operation can be achieved through

- RGB LUT — linearly amplifying the color channels that are too weak in the image and vice versa
- Color transformation matrix — which can also simply amplify or curtail individual channels, but can also "shift" the response of one channel to another one

Simplon API provides functions to help with white balancing. It would query the color handling functions supported by the connected camera (RGB LUT or color transformation matrix), inspect the target image buffer supplied by the application, calculate the necessary parameters needed to white-balance that buffer and configure the camera with those parameters. White balancing can be combined with the other LUT based operations, such as gamma correction, described above. The details are documented in Simplon programmer's guide.

# 6.11. Chunk data

This section discusses the additional info fields (so called "chunk data") optionally appended to every acquired image.

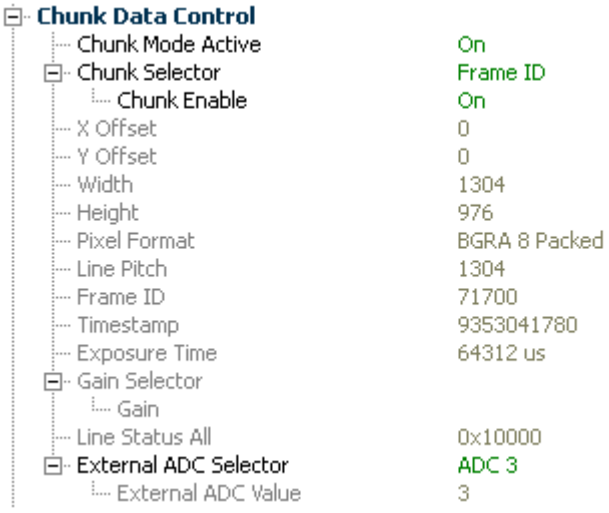


*Figure 6.47. Example GUI showing the chunk data features*

The chunk data are additional data optionally appended to every acquired image. The data can be retrieved through the feature tree, similarly as regular camera features. The individual chunks contain information about the camera status and configuration of certain important features at the time the image was acquired, thus providing additional information about the image. In triggered mode, the chunk data are collected in the moment of applying the frame trigger (effective exposure start). In free running mode, the chunk data are collected upon start of sensor readout.

The application can selectively choose, which chunks should be delivered. The chunk data are always delivered in the same buffer with the actual image data. The status of chunk data configuration thus affects the "payload size" (Section 6.4.1, "Acquired image data size" [p. 102]) and the application must consider that when allocating the acquisition buffers. The chunk data are always appended to the *end* of the buffer (in a standardized format), the image data are always in the beginning. Accessing the image data itself is thus not affected by the fact, whether the chunk data are used or not.

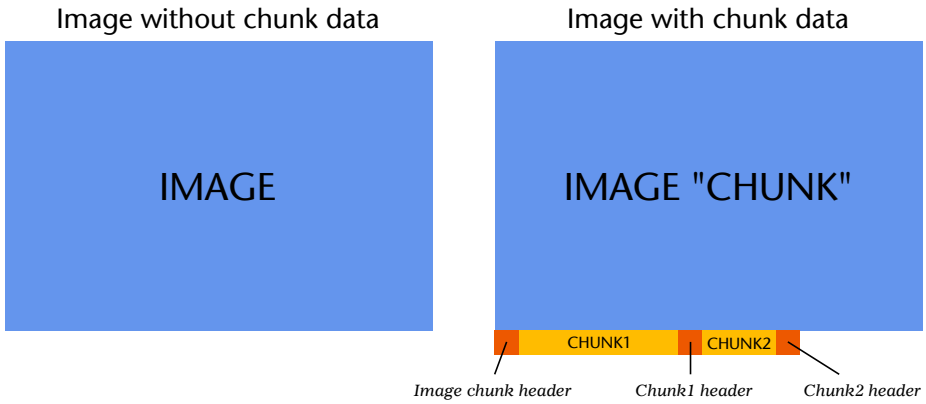


*Figure 6.48. Chunk data layout, the image data are always at the "start" of the buffer, chunk data parsed from the end of the delivered buffer*

Naturally, since the chunk data increase the image buffer size, the bandwidth required to deliver the image stream to the application also increases. However, the chunk data size is usually very small compared to the image data size, therefore its influence is marginal.

The GigE Vision compatible cameras (PicSight-GigE and PicSight-Smart) naturally deliver the chunk data with images using the GigE Vision payload types intended for chunk data. Other camera families, in particular CheckSight/CheckSight-II, deliver the image with chunk data through GenTL image acquisition engine. Note that all camera families, including CheckSight/CheckSight-II, deliver the chunk data in GigE Vision compatible format. Therefore every library/application capable of parsing the GigE Vision chunk data can use the same mechanism to parse also CheckSight/CheckSight-II chunk data.

Not all GigE Vision and GenICam based software packages are capable of working with the chunk data. If accessing the cameras through other library than Simplon API, please check its documentation to see if it supports chunk data parsing and delivery. Note that for GigE Vision cameras (PicSight-GigE and PicSight-Smart), part of the information available through the chunk data are also delivered in GigE Vision control packets (data leader and trailer). If your library provides access to those fields, they can be used alternatively instead of the chunk data.

In Simplon API, the library's acquisition engine delivers acquired image buffers. In chunk mode, it is responsibility of the application to specify, when the chunk data of a given buffer should be parsed and "attached" to the camera's feature tree. As soon as the library performs the chunk data processing in the given buffer, the values of individual chunks are available through corresponding camera features. The values will be available until another buffer's chunk data are processed — then the features are updated with new values. Note that it is important to process and read the chunk data before returning the buffer to the acquisition engine ("queuing" the buffer) — after that the buffers is owned by the acquisition engine and its contents is undefined. All needed details are documented in Simplon programmer's guide

In a 3rd party library, the mechanism might be similar, but it is important to study its documentation carefully to be sure how to retrieve the chunk data reliably.

## 6.11.1. Enabling chunk data

By default, the chunk data delivery is switched off. The application should switch on each particular chunk type it's interested in. It does so by selecting the desired chunk type in *Chunk Selector* feature and set the *Chunk Enable* boolean flag. It should repeat this procedure for all chunk types it wishes to monitor. Finally, the application must enable the chunk delivery mode through the *Chunk Mode Active* boolean feature. This feature allows to globally switch the chunk mode on and off, independently on which chunk types are currently selected.

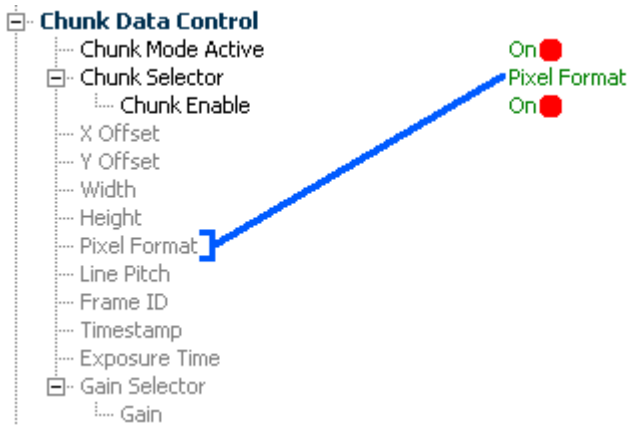


*Figure 6.49. Chunk "Pixel Format" enabled, associated feature highlighted*

Simplon

```
LvHDevice hDev; // open the device to get the handle
// switch to the chunk mode
LvSetBool (hDev, LvDevice_ChunkModeActive, 1);
// and enable the "ExposureTime" chunk delivery
LvSetEnum (hDev, LvDevice_ChunkSelector, LvChunkSelector_ExposureTime);
LvSetBool (hDev, LvDevice_ChunkEnable, 1);
// now the camera appends the exposure time chunk
// to every acquired image
// the application can process the chunk data in each delivered buffer
// and read associated feature values
while (NewAcquiredBuffersComing)
{
    LvHBuffer hBuf; // obtain handle of the acquired buffer
    LvBufferParseChunkData (hBuffer, 0);
    double FloatVal;
    LvGetFloat (hDev, LvDevice_ChunkExposureTime, &FloatVal);
}
// switch off the chunk mode, if desired
LvSetBool (hDev, LvDevice_ChunkModeActive, 1);
```

GEN<i>CAM

```
// switch to the chunk mode
write_bool (ChunkModeActive, true)
// and enable the "ExposureTime" chunk delivery
write_enum (ChunkSelector, ExposureTime)
write_bool (ChunkEnable, true)
// now the camera appends the exposure time chunk
// to every acquired image
// the application can process the chunk data in each delivered buffer
// and read associated feature values
while (NewAcquiredBuffersComing)
{
    // before reading the values, pass the buffer for chunk data parsing
    // unless your library does that implicitly
    read_float (ChunkExposureTime)
}
```

```
// switch off the chunk mode, if desired
write_bool (ChunkModeActive, false)
```

In Simplon API to read the chunk data values delivered in a buffer, the application has to pass the acquired buffer's handle to the chunk data parsing function, `LvBufferParseChunkData()`. Details including sample code are listed in Simplon programmer's guide. In other software packages, the procedure might be quite similar.

*The Simplon Explorer application will read the chunk data automatically, when enabled. It will parse the chunk data in every acquired buffer and update corresponding values in the feature tree. What it displays in the feature tree in a moment is of course the value associated with the currently displayed image.*

## 6.11.2. Chunk data features naming convention

As discussed above, each supported chunk is listed in the *Chunk Selector* enumeration and can be selectively enabled or disabled. The value of each supported and enabled chunk can be read through corresponding read only feature: for a chunk with name *XXX*, the chunk value feature is named `Chunk`*XXX*. When referring to an "array" of values of the same type (such as analog and digital `Gain`), the values are indexed using a selector feature, as usual (eg. `ChunkGainSelector`, `ChunkGain`).

For chunks carrying values of a camera configuration feature (such as `ExposureTime`), the chunk name is equivalent as the feature name itself. Of course, data types and value ranges are specific to each chunk.

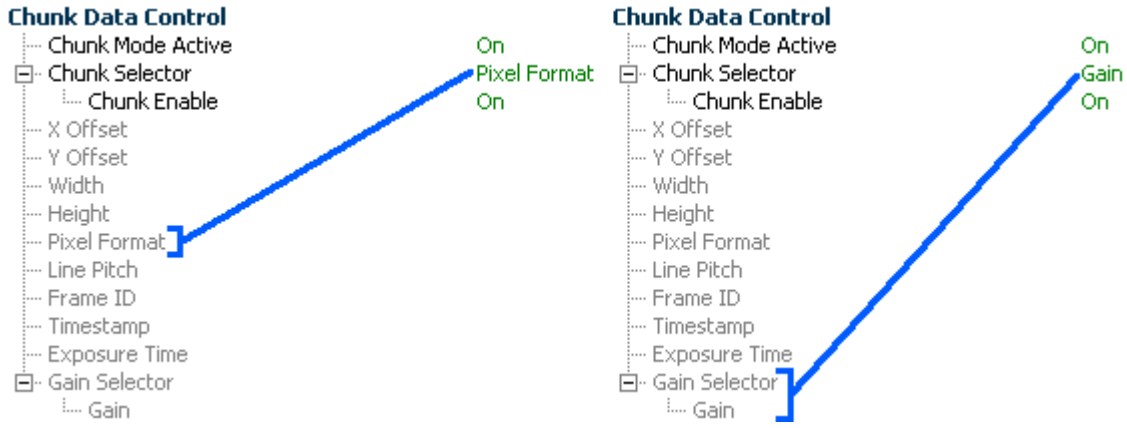


*Figure 6.50. Chunk data feature naming illustrated*

## 6.11.3. Chunk types

The Leutron Vision cameras currently support following chunk types:

| | |
|---|---|
| *Width* (`Width`) | Width of the image in the buffer. |
| *Height* (`Height`) | Height of the image in the buffer. |
| *X Offset* (`OffsetX`) | Horizontal AOI offset used when acquiring the image in the buffer. |
| *Y Offset* (`OffsetY`) | Vertical AOI offset used when acquiring the image in the buffer. |
| *Pixel Format* (`PixelFormat`) | Pixel format of the image in the buffer. |
| *Line Pitch* (`LinePitch`) | Line pitch (in bytes) of the image in the buffer. |

| | |
|---|---|
| *Timestamp* (`Timestamp`) | Value of the camera's timestamp counter at the moment the image was acquired (64-bit integer). The camera timestamp frequency is 1MHz, ie. the ticks correspond with time unit of 1 µs. |
| *Frame ID* (`FrameID`) | Value of the frame counter associated with the image in the buffer (64-bit integer). |
| *Exposure Time* (`ExposureTime`) | Exposure time used to acquire the image in the buffer. |
| *Gain* (`Gain`) | Gain used to acquire the image in the buffer. Since some camera models support two types of gain, analog and digital (refer to Section 6.9, "Analog controls" [p. 149]), the `ChunkGain` feature comes with a selector, `ChunkGainSelector`. To read the analog gain chunk (if supported by the camera), set the selector to `AnalogAll`, to read the digital gain, set `DigitalAll`. |
| *Black Level* (`BlackLevel`) | Black level used to acquire the image in the buffer. |
| *Line Status All* (`LineStatusAll`) | Bitfield reflecting status of all digital I/O lines (Section 6.7, "Digital I/O, counters and timers" [p. 136]) at the time the image was acquired. The least significant bit corresponds with `Line1`, next bit with `Line2` etc. |
| *External ADC Value* (`LvExternalADCValue`) | Status of the external ADC inputs (Section 6.14, "External device control" [p. 182]) at the time the image was acquired. Since the cameras are equipped with multiple external ADC's, the `ChunkLvExternalADCValue` feature comes with a selector, `ChunkLvExternalADCSelector`. To read a particular external ADC value chunk (if supported by the camera), select it first in the selector. |
| *Trigger Delayed* (`LvTriggerDelayed`) | Flag indicating, whether the frame trigger for the current image was delayed, because it was issued too early (before the camera could accept it).<br><br>Note that the way how early triggers are processed (cache/drop) can be controlled through feature *Trigger Caching* (Section 6.6, "Acquisition and trigger control" [p. 124]). Dropped triggers are signalled through asynchronous events (Section 6.12, "Asynchronous events" [p. 173]). |
| *Strobe Dropped* (`LvStrobeDropped`) | Flag indicating (for cameras supporting the integrated strobe ring only), whether the strobe pulse was dropped for the current image due to hardware constraints — in particular if the timing did not match the device capabilities (the trigger arrived before the device could accept it).<br><br>Note that the way how early strobe requests are processed (cache/drop) can be controlled through feature *Strobe Drop Mode*. |
| *Smart Application String* (`LvSmartAppString`) | A string that might be appended to the image by the "smart application" (running on PicSight-Smart). The contents and length of the string is defined by the respective application. |
| *Smart Application Signed Integer* (`LvSmartAppInt`) | One or more signed integer values that might be appended to the image by the "smart application" (running on PicSight-Smart). The contents and number of the values is defined by |

the respective application. Since multiple values might be delivered, the `ChunkLvSmartAppInt` feature comes with a selector, `ChunkLvSmartAppIntSelector`, which is an integer with range from 1 to the number of values in the chunk. To read the desired value, set the selector to point to the value of question.

*Smart Application Unsigned Integer* (`LvSmartAppUint`)

One or more unsigned integer values that might be appended to the image by the "smart application" (running on PicSight-Smart). The contents and number of the values is defined by the respective application. Since multiple values might be delivered, the `ChunkLvSmartAppUint` feature comes with a selector, `ChunkLvSmartAppUintSelector`, which is an integer with range from 1 to the number of values in the chunk. To read the desired value, set the selector to point to the value of question.

*Smart Application Register* (`LvSmartAppRegister`)

A raw register (memory buffer) that might be appended to the image by the "smart application" (running on PicSight-Smart). The contents and length of the register is defined by the respective application.

## 6.12. Asynchronous events

This section discusses the asynchronous event (and associated data) delivery.

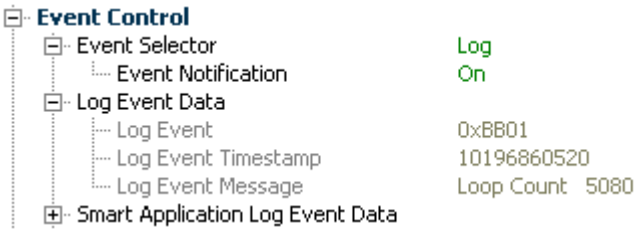


*Figure 6.51. Example GUI showing the asynchronous event features*

Besides the acquired images, and possibly additional "chunk" data appended to images(Section 6.11, "Chunk data" [p. 168], the cameras can deliver additional "asynchronous" messages. The events are delivered through a separate channel, independent on the streaming channel (images) and control channel (camera configuration), therefore "asynchronous".

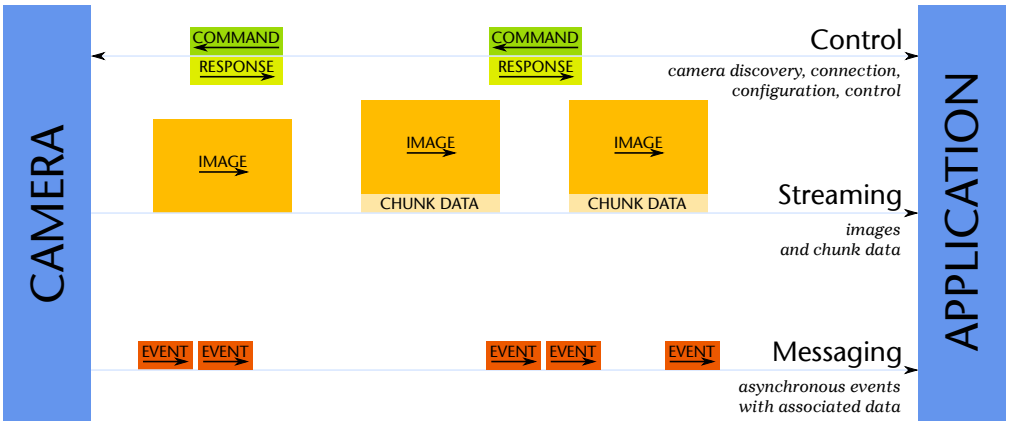


*Figure 6.52. Camera communication channels*

The events can be just a simple messages (such as signalling occurrence of an incident, such as error), but usually they carry additional data. The data can be retrieved through the feature tree, similarly as regular camera features. All the events have associated timestamp, which is the value of the camera's timestamp counter (refer to Section 6.3, “Information about the camera” [p. 98]) at the time the event was generated. The camera timestamp frequency is 1MHz, ie. the ticks correspond with time unit of 1 µs.

The GigE Vision compatible cameras (PicSight-GigE and PicSight-Smart) naturally deliver the events through the GigE Vision message channel. Other camera families, in particular CheckSight/CheckSight-II, deliver the events through GenTL event signalling mechanism. Note that all camera families, including CheckSight, deliver the event data in GigE Vision compatible format. Therefore every library/application capable of parsing the GigE Vision event data can use the same mechanism to parse also CheckSight/CheckSight-II event data.

Not all GigE Vision and GenICam based software packages are capable of working with the asynchronous events. If accessing the cameras through other library than Simplon API, please check its documentation to see if it supports asynchronous event delivery and event data parsing.

In Simplon API, the library deliver callbacks to your application, whenever an asynchronous event arrives (provided that you have registered for the callback delivery). The callbacks will signal all the features corresponding with the data delivered with the event — announcing the application that it can read the new event data. It is important to read the data directly withing the callback, which is executed in the context of the Simplon API event delivery thread. After leaving the callback, the event delivery thread continues and the event data feature values might eventually be overwritten by a following event. All needed details are documented in Simplon programmer's guide.

In a 3rd party library, the mechanism might be similar, but it is important to study its documentation carefully to be sure how to retrieve the event data reliably.

## 6.12.1. Enabling events

By default, the event delivery is switched off. The application should switch on each particular event type it's interested in. It does so by selecting the desired event type in *Event Selector* feature and adjust the *Event Notification* feature to *On* (note that due to the compatibility with the SFNC standard, this feature is not a boolean, but an enumeration with two options, *On* and *Off*). It should repeat this procedure for all event types it wishes to monitor.

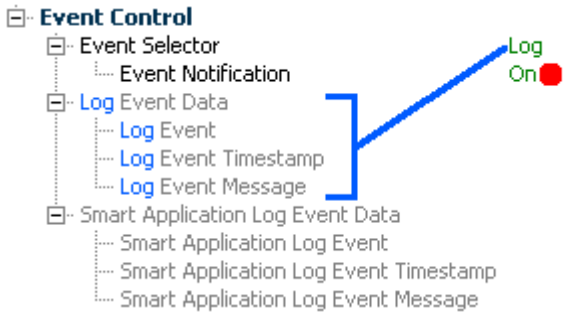


*Figure 6.53. Event type “Log” enabled, subcategory with features carrying the associated data highlighted*

```
LvHDevice hDev; // open the device to get the handle
// enable the "Log" events delivery
LvSetEnum (hDev, LvDevice_EventSelector, LvEventSelector_LvLog);
LvSetEnum (hDev, LvDevice_EventNotification, LvEventNotification_On);
```

```
// now the camera starts generating the log events whenever appropriate
// provided that a callback was registered for the log event (LvDevice_EventLvLo
// the application can monitor them and read associated event data
while (NewLogEventsComing)
{
    char StringVal[1024];
    LvGetString (hDev, LvDevice_EventLvLogMessage, StringVal, 1024);
    int64_t Int64Val;
    LvGetInt64 (hDev, LvDevice_EventLvLogTimestamp, &Int64Val);
}
// disable the "Log" events delivery
LvSetEnum (hDev, LvDevice_EventSelector, LvEventSelector_LvLog);
LvSetEnum (hDev, LvDevice_EventNotification, LvEventNotification_Off);
```

GEN<i>CAM

```
// enable the "Log" events delivery
write_enum (EventSelector, LvLog)
write_enum (EventNotification, On)
// now the camera starts generating the log events whenever appropriate
// provided that event delivery was registered for the log event (EventLvLog)
// the application can monitor them and read associated event data
while (NewLogEventsComing)
{
    // before reading the values, pass the event buffer for data parsing
    // unless your library does that implicitly
    read_string (EventLvLogMessage)
    read_int (EventLvLogTimestamp)
}
// disable the "Log" events delivery
write_enum (EventSelector, LvLog)
write_enum (EventNotification, Off)
```

In Simplon API there are two actions needed to receive the asynchronous event notifications. First, the event receiving and dispatching thread must be started (`LvEventOpen(LvEventType_FeatureDevEvent)`, `LvEventStartThread()`). Second, callbacks need to be registered on the features associated with the desired event (`LvRegisterFeatureCallback()`) — the rules about event feature naming are discussed below in Section 6.12.2, “Event features naming convention” [p. 176]. Details including sample code are listed in Simplon programmer's guide. In other software packages, the procedure might be quite similar.

*The Simplon Explorer application will capture the events automatically, when enabled. It will parse the event data and update corresponding values in the feature tree. What it displays in the feature tree in a moment is of course the value associated with the last delivered event. The event history is not recorded in Simplon Explorer.*

*The only exception are the logging messages, which might be recorded and displayed in a separate panel. This functionality is, however, only intended for customer support. If the support case requires it, our support staff will provide instructions how to capture the relevant camera log. Complete user interface of the Simplon Explorer is described in Simplon programmer's guide.*

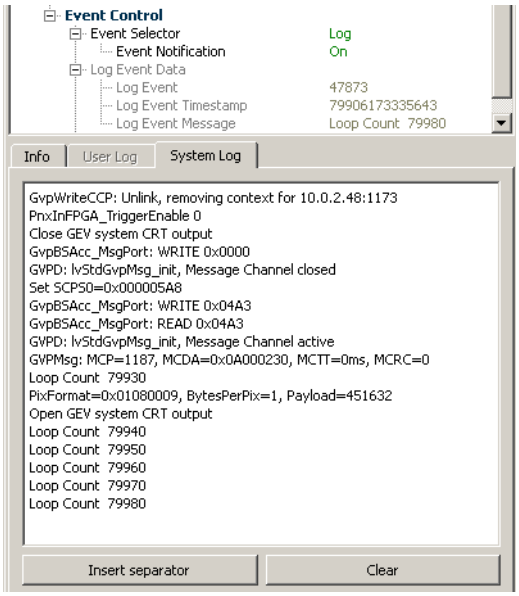


*Figure 6.54. Camera log displayed in Simplon Explorer*

## 6.12.2. Event features naming convention

The naming of event related features follows the recommendation of the GenICam SFNC standard. As described earlier, each supported event is listed in the *Event Selector* enumeration and can be selectively enabled or disabled. Each supported event comes with a set of additional features following fixed naming scheme.

Let's describe the naming scheme for a hypothetical event with name *XXX*:

`Event`*`XXX`*`Data` — A subcategory of the `EventControl` category. This subcategory contains all the features specific to the *XXX* event.

`Event`*`XXX`* — Read only integer feature. Its main purpose is that it can be used for registering the callback, when listening for given events. Each time the event of this type is generated by the camera, the callback would be called (note that other libraries than Simplon API might use other mechanism than callbacks for signalling the event). Note that when monitoring an event carrying some event data, registering the callback on the data field would also work. The `Event`*`XXX`* feature is just available for every single event type.

The value of the `Event`*`XXX`* integer is always the ID of the respective event type. Note that every event type is internally identified by a unique numeric ID. The ID is, however, not important for most applications, and especially to Simplon API based ones, since it is not needed for event monitoring.

`Event`*`XXX`*`Timestamp` — Every single generated event carries a timestamp — value of the camera's timestamp counter at the time the event was generated. It is a 64-bit integer value.

`Event`*`XXXyyy`* — Feature(s) carrying value(s) of the event data "*yyy*" associated with the given event. For each event type there might be multiple event data fields, single field or even none. The data type and value range of individual fields might also be different for each event type.

The same features are used for all instances of given event, so at every moment, they provide the value(s) carried by the last delivered event. As soon as the next event instance is delivered, the values are overwritten by the new data.

*When using a software package that does not support event delivery, no callbacks will be delivered and it will not be possible to read any event data. The event related features will not be even available for reading.*

To demonstrate the rules on a real example — the "log" events of PicSight-GigE cameras are identified by `LvLog` entry in the `EventSelector`. The name of the subcategory related to the event data is `EventLvLogData`. The primary target for registering the callback for this event is `EventLvLog`. The subcategory also contains the "timestamp" feature `EventLvLogTimestamp` and a single data feature specific to this event type, in this case `EventLvLogMessage`. Note that other event types might carry multiple event specific data fields as well as none of them.

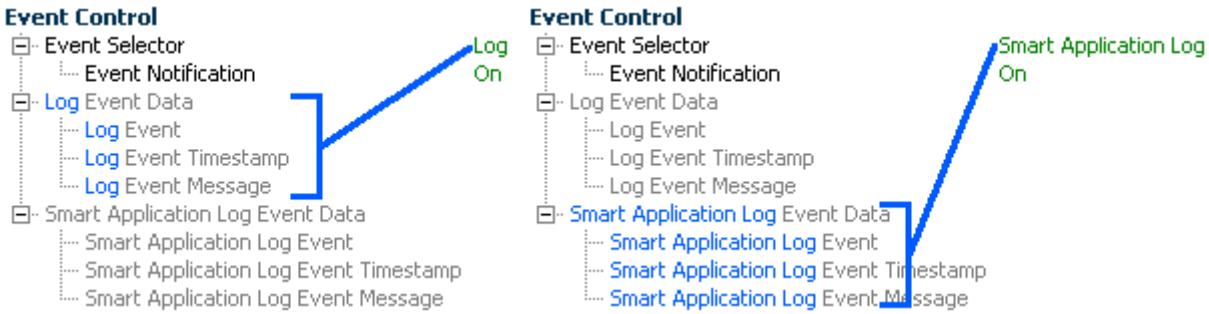


*Figure 6.55. Event naming convention illustrated*

## 6.12.3. Event types

The Leutron Vision cameras currently support following event types:

*Log* (`LvLog`)

Camera logging messages. Intended for troubleshooting and support purposes. If needed, our support staff will provide instructions, how to capture the entire log. Please note that the log contents is intended to be interpreted solely by our support staff, it does not provide any information useful for the camera user. Therefore please do not try to interpret its contents or report to us log contents that you potentially find "suspiciouis". Under normal circumstances the log events should be switched off so that they do not occupy the camera link.

Event ID for this event type is `0xBB01`.

Event specific data fields:

- `EventLvLogMessage` — log message as string of variable length. If a log message is too long (longer than the maximal possible event data size allowed by the GigE Vision standard), the camera splits it among multiple events.

*Trigger Dropped* (`LvTriggerDropped`)

Message signalling that a frame trigger was dropped, because it was issued too early (before the camera could accept it).

Note that the way how early triggers are processed (cache/drop) can be controlled through feature *Trigger Caching* (Section 6.6, "Acquisition and trigger control" [p. 124]). Info

about delayed triggers are delivered through within chunk data for the corresponding image (Section 6.11, “Chunk data” [p. 168]).

Event ID for this event type is `0xBB07`.

Event specific data fields: none, this event type serves as a pure “signal” carrying just the timestamp.

*Smart Application Log* (`LvSmartAppLog`)

The smart application log event is analogical to the regular log event, but it's dedicated for use by smart applications (running on PicSight-Smart cameras). The contents and purpose of the log messages is thus strictly specific to the running smart application.

Event ID for this event type is `0xBB02`.

Event specific data fields:
- `EventLvSmartAppLogMessage` — smart application “log” message as string of variable length. If a message is too long (longer than the maximal possible event data size allowed by the GigE Vision standard), the camera splits it among multiple events.

*Smart Application String* (`LvSmartAppString`)

An asynchronous string message generated by the “smart application” (running on PicSight-Smart). The contents and length of the string is defined by the application. Strings delivered through this event type are not considered by the logging facilities.

Event ID for this event type is `0xBB03`.

Event specific data fields:
- `EventLvSmartAppStringValue` — the string itself.

*Smart Application Signed Integer* (`LvSmartAppInt`)

Asynchronous message carrying one or more signed integer values, generated by the “smart application” (running on PicSight-Smart). The contents and number of the values is defined by the application.

Event ID for this event type is `0xBB04`.

Event specific data fields:
- `EventLvSmartAppIntSelector` — selects one of the values delivered in the message. It is an integer with range from 1 to the number of values in the message. To read the desired value, set the selector to point to the value of question.
- `EventLvSmartAppIntValue` — reads the signed integer value the selector points to.

*Smart Application Unsigned Integer* (`LvSmartAppUint`)

Asynchronous message carrying one or more unsigned integer values, generated by the “smart application” (running on PicSight-Smart). The contents and number of the values is defined by the application.

Event ID for this event type is `0xBB05`.

Event specific data fields:

- `EventLvSmartAppUintSelector` — selects one of the values delivered in the message. It is an integer with range from 1 to the number of values in the message. To read the desired value, set the selector to point to the value of question.
- `EventLvSmartAppUintValue` — reads the unsigned integer value the selector points to.

*Smart Application Register* (`LvSmartAppRegister`)

A raw register (memory buffer) message generated by the "smart application" (running on PicSight-Smart). The contents and length of the register is defined by the application.

Event ID for this event type is `0xBB06`.

Event specific data fields:
- `EventLvSmartAppRegisterValue` — the "register" feature carrying the raw memory data.

# 6.13. User sets (saving/loading camera configuration)

This section discusses options to store and reuse camera configuration sets.

*Figure 6.56. Example GUI showing the user sets' features*

## 6.13.1. Features defining camera configuration

The set of features that the user can control make up the camera configuration. The complete current configuration can be at any point stored away and later re-loaded to bring the camera back to the status when the configuration snapshot was saved. The configuration user set handling can be performed directly by the camera or by the application itself — both approaches are discussed below.

It's important to understand, which features belong to the user set and will thus be "remembered". Let's list few rules:

- Refer to Section 6.17, "Feature summary" [p. 203] — features marked as "streamable" will be stored in the user sets.
- In general, the user sets consist of all the read-writable features, ie. those that can be written and retrieved back.
- Features depending on a "selector", ie. array-like features are stored for all possible selector values (the entire array is always stored and re-loaded). If a feature is available and read-writable only for some selector values, than only those entries will be part of the user set.
- Naturally read-only features (such as serial number or model name) are not part of the user sets. Remember, that being read-only does not necessarily mean the feature is constant. For example, if in DHCP mode, the camera might have different IP address at each run, but still the "current IP address" feature will not be part of the user set — ie. the IP address would not be restored.
- Commands are not part of the user set. No commands can be executed while re-loading the configuration.

- There are few exceptions among the read-writable features, that do not belong to the user sets. These are the low-level features used to set-up the basic connection with the camera. These features are always under direct access of the camera controlling library and trying to restore their values among sessions makes no sense.
- The same applies for features defining identify of the camera (such as its persistent IP address or user name). These values are anyway persisted by the camera — and trying to apply them to multiple cameras through software controlled configuration set functionality would lead to unwanted results.
- The default user configuration set used during camera boot is also not stored.
- The smart application control features (Section 6.16, “Smart application control” [p. 200]) are not included. The meaning and purpose of these registers is strictly specific to each smart application and cannot be known in advance which of them should define application status. They should be therefore handled separately.

The user sets are designed to be expectable, storing a configuration away and reloading it back brings the camera to the same status as when the configuration snapshot was made.

*The user set storing/loading should be performed only when acquisition is not active. Once the acquisition is started, some features are not writable any more and the camera will not allow adjusting their values or load a user set.*

## 6.13.2. Camera's user configuration sets

The camera can store up to five configuration sets, one with factory default settings (*Default User Set*) and four user configurable sets (*User Set 1* to *User Set 4*).

The set with factory defaults is fixed, cannot be written. The settings include free running working mode and full resolution image. Also defaults for other settings are chosen to be expectable — if needed, the default behavior for each feature is documented together with the feature itself.

The user sets can be used to save “snapshots” of particular camera configurations and reuse them later. After adjusting the desired configuration, it can be stored to the camera's persistent memory by selecting the desired set in *User Configuration Set Selector* feature and invoking the *User Set Save* command. To load them later, one invokes the *User Set Load* command, having the desired set selected.

Note that after loading a configuration set, virtually any feature might change its value. Therefore the application might need to re-read the entire feature tree to know the new camera configuration.

Finally, it is possible to choose, which of the configuration sets will be applied during camera boot. Usually the factory defaults are used, but it is possible to use one of the user sets instead. The boot-up configuration set is selected through the *Default Startup Set* feature. The same default set will be also applied after resetting the camera using the *Reset Device* command and even every time when opening the camera connection from the application.

In some situations, it might be preferable that the camera configuration is not reset on every disconnect/connect loop. To keep the camera settings across multiple connections, the PicSight-GigE/PicSight-Smart cameras allow to set the *Default Startup Set* to *None*.

On the PicSight-Smart cameras, when a “smart application” takes control over the camera, it is not desirable at all that the configuration gets reset whenever a connection to the camera is opened from a remote host. Therefore, whenever a “smart application” gains control over the camera, opening the connection has no effect on the camera settings (the default startup set is not applied).

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Note that when *Default Startup Set* is set to *None*, the camera will use the factory default settings when booting or being reset. Note that this option is not available at all on the CheckSight/CheckSight-II cameras.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// store current configuration in user set #1
LvSetEnum (hDev, LvDevice_UserSetSelector, LvUserSetSelector_UserSet1);
LvCmdExecute (hDev, LvDevice_UserSetSave);
// load and apply settings stored in user set #4
LvSetEnum (hDev, LvDevice_UserSetSelector, LvUserSetSelector_UserSet4);
LvCmdExecute (hDev, LvDevice_UserSetLoad);
// load and apply factory default settings
LvSetEnum (hDev, LvDevice_UserSetSelector, LvUserSetSelector_Default);
LvCmdExecute (hDev, LvDevice_UserSetLoad);
// use settings stored in user set #2 after during camera boot
LvSetEnum (hDev, LvDevice_UserSetDefaultSelector,
                 LvUserSetDefaultSelector_UserSet2);
```

GENICAM

```
// store current configuration in user set #1
write_enum (UserSetSelector, UserSet1)
exec_cmd (UserSetSave)
// load and apply settings stored in user set #4
write_enum (UserSetSelector, UserSet4)
exec_cmd (UserSetLoad)
// load and apply factory default settings
write_enum (UserSetSelector, Default)
exec_cmd (UserSetLoad)
// use settings stored in user set #2 after during camera boot
write_enum (UserSetDefaultSelector, UserSet2)
```

## 6.13.3. Software control of configuration sets

Besides the camera controlled configuration handling, the application might want to store/reload the configuration on its own. The configuration description stored by the application could be modified or reused for multiple compatible cameras.

Because of dependencies among individual features, however, the application has no way to know the correct order in which the features should be set to reach the desired goal reliably. The GenICam standard provides a solution for that, called “register streaming”, which is a standardized way to save/load full camera configuration. It was discussed before in Section 6.3.5, “Register streaming support” [p. 101]. Our cameras provide full support for register streaming.

Simplon API implements this functionality in `LvCameraSaveSettings()` and `LvCameraLoadSettings()` functions, see details in Simplon programmer's guide. Other GenICam compatible software packages should also provide similar functionality.

Besides that, the Simplon Source Code Generator (component of the Simplon Explorer) allows to record all feature settings, including executed commands. The recorded actions are provided by the Simplon Source Code Generator in form of source code that can be easily included in the user application.

### 6.13.4. Comparison of the two methods

Both methods of handling the user configuration sets, directly on the camera or by the application, have their advantages and disadvantages:

- The on-camera user set “travels” with the camera, independently on the application with which it is used. It is fully under camera control, so it is always correct — mistakes such as applying the user set to incompatible camera type or version are not possible.
- The camera's default user set is applied directly at camera boot, before any application even connects to it.
- The software controlled user sets can be stored once and applied to many cameras of the same type.
- The software controlled user sets might be edited by qualified personnel, although it must be done with maximum care.
- The action recorder/playback functionality can include command execution. On the other side, it strongly depends on the initial camera status.

## 6.14. External device control

The section documents features for camera's external device (peripheral) control. The features include ADC's for monitoring analog inputs, power switches for driving external motors or other devices or serial port communication. The combined power switch and ADC (feedback) components can be used together for automatic lens control. Peripheral devices can be controlled over a serial port interface.

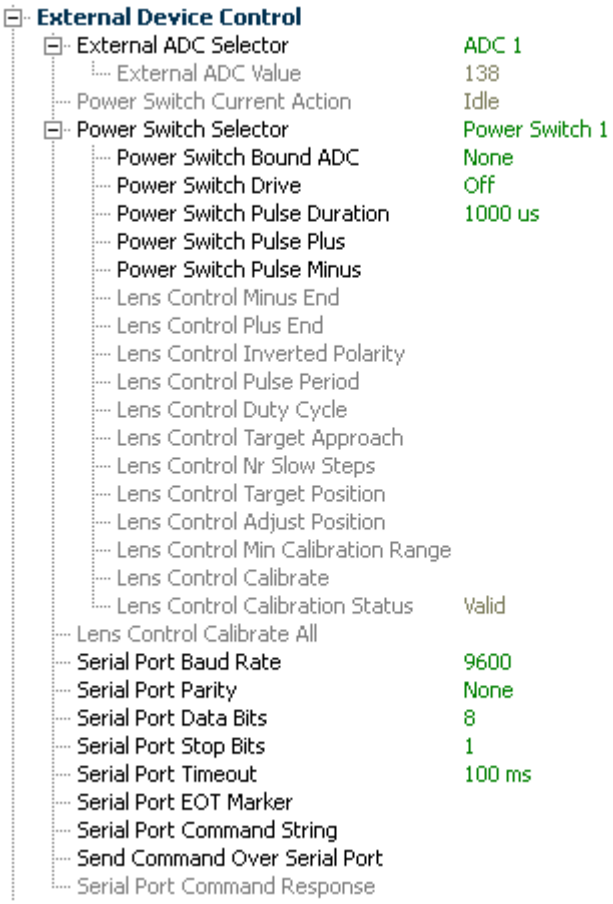


*Figure 6.57. Example GUI showing the external device control features*

## 6.14.1. External ADC's (analog inputs)

The cameras might be equipped with up to 3 analog input, connected to A/D converters — the application can monitor the inputs' digitized value. The components are called “external ADC's” because they are digitizing external analog signals. They can be used as feedbacks for automatic lens control (Section 6.14.3, “Lens control” [p. 187]), but also independently to read any external analog signal within a given range.

The external ADC's have 8-bit resolution, digitizing voltage range of 0—3.3 V — input voltage of 0 V yields digitized value `0`, 3.3 V yields `255` and the response is linear. There is no overvoltage and polarity protection, the user is responsible for connecting correct signal. The maximal scanning frequency is in range of 10 kHz. More technical details are available in Section 3.7.7, “Lens control interface (External ADC's & Power switches)” [p. 44].

To read the digitized value of an external ADC, select the desired ADC in *External ADC Selector* and then read the *External ADC Value*.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// read current value of external ADC #1
LvSetEnum (hDev, LvDevice_LvExternalADCSelector,
                 LvExternalADCSelector_ExternalADC1);
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_LvExternalADCValue, &IntVal);
```

GEN<i>CAM

```
// read current value of external ADC #1
write_enum (LvExternalADCSelector, ExternalADC1)
read_int (LvExternalADCValue)
```

## 6.14.2. Power switches

The cameras might be equipped with up to three power switches — the application can switch them between plus/minus polarity or switch them off. The power switch status can be either controlled directly (manual mode) or through higher level features (automatic mode). They can be used as motor drives for automatic lens control (Section 6.14.3, “Lens control” [p. 187], but also independently to control any external device, such as motorized positioning stages, LED illuminators and others.

The default switched output voltage is 5 V, supplied directly off the camera, with maximal output current 50 mA — suitable to drive most lens control motors. For other power options, please contact Leutron Vision. Internally each of the power switches is realized as an H-bridge. The power switches are protected against overvoltage and short circuit. More technical details are available in Section 3.7.7, “Lens control interface (External ADC's & Power switches)” [p. 44].

### 6.14.2.1. Operating modes

As mentioned before, the power switches can be used in two basic operating modes:

Manual — The power switch is controlled directly and treated independently on any feedback. It is possible to connect the switch with either polarity, disconnect it, or issue pulses of desired length. To control a switch in the manual mode, no feedback must be bound to it through *Power Switch Bound ADC* feature. Details about the manual mode will be discussed shortly below.

Automatic — The power switch operates in a pair with it bound feedback (*Power Switch Bound ADC*). This mode assumes that the external device controlled through the power switch provides feedback about its actual status (e.g. position) through an external ADC input. The power switch and external ADC pair must be first calibrated and the higher level functions then allow to adjust the external device to a desired “position” — while the camera controls the power switch internally, monitoring the status of the controlled device using the feedback.

Typical application is automatic lens control, as names of the corresponding features imply. The features will be discussed in a separate section, Section 6.14.3, “Lens control” [p. 187].

Note that the two operating modes are mutually exclusive, i.e. when an external ADC is bound to the power switch, only the automatic (lens control) features are available, when no external ADC is bound, only the manual mode features are available.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// set the power switch 1 to the 'automatic' mode
// binding feedback from external ADC 1 to it...
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvSetEnum (hDev, LvDevice_LvPowerSwitchBoundADC,
                 LvPowerSwitchBoundADC_ExternalADC1);
// ...now 'automatic' (lens control) features are available
// set the power switch 1 to the 'manual' mode...
```

```
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvSetEnum (hDev, LvDevice_LvPowerSwitchBoundADC,
                 LvPowerSwitchBoundADC_None);
// ...now 'manual control' features are available
```

GENICAM

```
// set the power switch 1 to the 'automatic' mode
// binding feedback from external ADC 1 to it...
write_enum (LvPowerSwitchSelector, PowerSwitch1)
write_enum (LvPowerSwitchBoundADC, ExternalADC1)
// ...now 'automatic' (lens control) features are available
// set the power switch 1 to the 'manual' mode...
write_enum (LvPowerSwitchSelector, PowerSwitch1)
write_enum (LvPowerSwitchBoundADC, None)
// ...now 'manual control' features are available
```

### 6.14.2.2. Power switch's operation serialization

The power switch control subsystem is able to handle just a single operation at a time. To keep it predictable, no request queuing is done by the camera, the application is responsible for serializing the operations properly and not issue a new request while other operation on one of the power switches is still in progress.

The camera reports when a given operation is finished properly through its GenICam interface — for every "command" feature, the progress is reported through its "IsDone" property. In Simplon API, this can be monitored using the `LvCmdIsDone()` function, other GenICam compliant libraries should provide similar mechanism.

Alternatively, the currently active operation can be also retrieved through the *Power Switch Current Action* feature. This read-only enumeration reports status of the entire power switch subsystem (reports operation pending on any of the power switches, regardless of which is selected in the *Power Switch Selector*). It can have following values:

| | |
|---|---|
| *Idle* | All power switches are idle — the system is ready for a new request. |
| *Drive* | One of the power switches is currently driven with either polarity in the manual mode. |
| *Pulse* | Manual mode's pulse operation is in progress on one of the power switches. |
| *Calibrate* | One or more power switches are just being calibrated in the automatic mode. |
| *Adjust Position* | The automatic mode's adjust position operation is in progress on one of the power switches. |

Simplon

```
LvHDevice hDev; // open the device to get the handle
// check which (if any) power switch operation is currently active
int32_t EnumVal;
LvGetEnum (hDev, LvDevice_LvPowerSwitchCurrentAction, &EnumVal);
```

GENICAM

```
// check which (if any) power switch operation is currently active
read_enum (LvPowerSwitchCurrentAction)
```

### 6.14.2.3. Manual control mode

In the manual mode the status of the power switches is controlled directly among three states:

*Off* The switch is disconnected (both sides of the H-bridge floating), the output yields 0 V.

*Plus* The switch is connected with plus polarity, yielding +5 V.

*Minus* The switch is connected with minus polarity, yielding -5 V.

The desired switch should be selected through *Power Switch Selector* and its status controlled through *Power Switch Drive* enumeration (values *Off*/*Plus*/*Minus*). Only the selected power switch is driven, other power switches remain disconnected.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// switch the power switch 1 to 'manual' control mode, if needed
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvSetEnum (hDev, LvDevice_LvPowerSwitchBoundADC,
                 LvPowerSwitchBoundADC_None);
// drive it with 'plus' polarity (+5V output)
LvSetEnum (hDev, LvDevice_LvPowerSwitchDrive,
                 LvPowerSwitchDrive_Plus);
// and switch it off again (0V output)
LvSetEnum (hDev, LvDevice_LvPowerSwitchDrive,
                 LvPowerSwitchDrive_Off);
// drive it with 'minus' polarity (+5V output)
LvSetEnum (hDev, LvDevice_LvPowerSwitchDrive,
                 LvPowerSwitchDrive_Minus);
// and switch it off again (0V output)
LvSetEnum (hDev, LvDevice_LvPowerSwitchDrive,
                 LvPowerSwitchDrive_Off);
```

GEN<i>CAM

```
// switch the power switch 1 to 'manual' control mode, if needed
write_enum (LvPowerSwitchSelector, PowerSwitch1)
write_enum (LvPowerSwitchBoundADC, None)
// drive the power switch 1 with 'plus' polarity (+5V output)
write_enum (LvPowerSwitchDrive, Plus)
// and switch it off again (0V output)
write_enum (LvPowerSwitchDrive, Off)
// drive the power switch 1 with 'minus' polarity (+5V output)
write_enum (LvPowerSwitchDrive, Minus)
// and switch it off again (0V output)
write_enum (LvPowerSwitchDrive, Off)
```

Besides directly connecting/disconnecting the power switch, a pulse of exactly defined length can be issued. The length of the pulse is set through *Power Switch Pulse Duration* (in µs), the pulse itself, with plus or minus polarity, is started using commands *Power Switch Pulse Plus* and *Power Switch Pulse Minus*.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// switch the power switch 1 to 'manual' control mode, if needed
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvSetEnum (hDev, LvDevice_LvPowerSwitchBoundADC,
                 LvPowerSwitchBoundADC_None);
// 'pulse' the power switch 1 with 'plus' polarity for 5000µs
LvSetFloat (hDev, LvDevice_LvPowerSwitchPulseDuration, 5000.0);
LvCmdExecute (hDev, LvDevice_LvPowerSwitchPulsePlus);
// now again with 'negative' polarity
LvCmdExecute (hDev, LvDevice_LvPowerSwitchPulseMinus);
```

GEN<i>CAM

```
// switch the power switch 1 to 'manual' control mode, if needed
write_enum (LvPowerSwitchSelector, PowerSwitch1)
write_enum (LvPowerSwitchBoundADC, None)
// 'pulse' the power switch 1 with 'plus' polarity for 5000µs
write_float (LvPowerSwitchPulseDuration, 5000.0)
exec_cmd (LvPowerSwitchPulsePlus)
// now again with 'negative' polarity
exec_cmd (LvPowerSwitchPulseMinus)
```

## 6.14.3. Lens control

The functionality of the power switches and external ADC's, described above, can be used together for intelligent control of motorized lenses or similar devices. In this case, a pair power switch/external ADC are working together, the power switch driving the lens motor, the external ADC serving as feedback indicating the current lens position.

The features are named after the most important use case, but can be in fact used to control other devices based on the drive/feedback principle, provided that the external ADC and power switch specifications (feedback voltage, switched power and current, etc.) meet the external device requirements.

*The lens control functionality can only work properly if the power switch and external ADC are cooperating properly. If position feedback is not available for given lens function or not connected properly to the external ADC, the lens control commands will fail (the result would be undefined). In such case, the function (lens motor) should only be controlled by direct power switch adjustments, as described above. The bound external ADC should be connected in a way so that driving the power switch with minus polarity decreases the feedback value, plus polarity increases the feedback value.*

### 6.14.3.1. Generic lens control

The generic lens control functionality provides generic hardware oriented features allowing to control a pair of motor drive (power switch) and feedback (external ADC). It cannot provide high level access to the lens functions and therefore it should be avoided, whenever the high level control is available for given lens type (described below). On the other side, the interface is fully generic and can be used to control “unknown” lens types or other similar devices.

*For certain set of selected lens types (see Section 3.7.7, “Lens control interface (External ADC's & Power switches)” [p. 44]), lens control cables are available. All these cables assume following mapping of lens functions to power switches and external ADC's (see also Section 3.8, “Connector and cable description” [p. 44]):*

- *Zoom — If zoom function is supported, the zoom motor is wired to be controlled by Power Switch 1. If the camera provides feedback about the zoom position, it is wired to External ADC 1.*
- *Focus — If focus function is supported, the focus motor is wired to be controlled by Power Switch 2. If the camera provides feedback about the focus position, it is wired to External ADC 2.*
- *Iris — If iris function is supported, the iris motor is wired to be controlled by Power Switch 3. If the camera provides feedback about the iris position, it is wired to External ADC 3.*

The lens control operation consists of three steps, binding feedbacks (external ADC's) to drives (power switches), calibrating the individual pairs, and finally control of the individual lens functions.

### Binding external ADC to a power switch

Before accessing any lens control related features on a given power switch, it is necessary to “bind” the external ADC providing feedback about the current status (position) of given lens function. The binding are configure for each power switch through the *Power Switch Bound ADC* enumeration. When no external ADC is bound, the lens control functions won't be available at all.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// bind External ADC 1 to Power Switch 1 and ADC 2 to Switch 2
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvSetEnum (hDev, LvDevice_LvPowerSwitchBoundADC,
                 LvPowerSwitchBoundADC_ExternalADC1);
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch2);
LvSetEnum (hDev, LvDevice_LvPowerSwitchBoundADC,
                 LvPowerSwitchBoundADC_ExternalADC2);
// do not bind any External ADC to Power Switch 3
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch3);
LvSetEnum (hDev, LvDevice_LvPowerSwitchBoundADC,
                 LvPowerSwitchBoundADC_None);
```

GEN<i>CAM

```
// bind External ADC 1 to Power Switch 1 and ADC 2 to Switch 2
write_enum (LvPowerSwitchSelector, PowerSwitch1)
write_enum (LvPowerSwitchBoundADC, ExternalADC1)
write_enum (LvPowerSwitchSelector, PowerSwitch2)
write_enum (LvPowerSwitchBoundADC, ExternalADC2)
// do not bind any External ADC to Power Switch 3
write_enum (LvPowerSwitchSelector, PowerSwitch3)
write_enum (LvPowerSwitchBoundADC, None)
```

### Calibrating the power switch/external ADC pair

The lens control logic needs to know about the relationships between power switch and its bound external ADC and about the expected behavior of the pair. The configuration is described by several parameters — these can be initialized through an automatic calibration procedure performed by the camera, or, once known, the application can set the parameters directly without performing the calibration again (we'll come back to this later). Note that depending on the external device being controlled, the system might need re-calibration when environment changes significantly.

The calibration is started on a selected power switch using the *Lens Control Calibrate* command. Note that the calibration will typically take a couple of seconds. The application should wait until the command is finished and then eventually start using the calibrated power switch/external ADC pair. The camera reports, whether the calibration was successful through a read-only feature *Lens Control Calibration Status*, which can read simply either *Valid* or *Invalid*. When not successful, the lens control functionality cannot be used and the corresponding features will be disabled.

The calibration procedure first drives the power switch to plus and minus sides, observing the min/max feedback values that can be achieved and the power switch polarity required to reach them. After that it moves to the middle of the interval and empirically finds the slow motion parameters leading to feedback change by 1 per power switch pulse (for optimal operation, the lens control subsystem slows down the motor shortly before reaching the target position, to adjust it precisely).

For convenience, all the power switches can be calibrated at once using the *Lens Control Calibrate All* command, which operates on all switches that have an external ADC bound.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// (assuming that correct External ADC is bound)
// calibrate the Power Switch 1 with its bound External ADC
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvCmdExecute (hDev, LvDevice_LvLensControlCalibrate);
// now wait until the operation end using LvCmdIsDone(),
// then possibly verifying if it was successful
int32_t EnumVal;
LvGetEnum (hDev, LvDevice_LvLensControlCalibrationStatus, &EnumVal);
// as a convenience, all bound power switches
// can be calibrated at once
LvCmdExecute (hDev, LvDevice_LvLensControlCalibrateAll);
```

GEN<i>CAM

```
// (assuming that correct External ADC is bound)
// calibrate the Power Switch 1 with its bound External ADC
write_enum (LvPowerSwitchSelector, PowerSwitch1)
exec_cmd (LvLensControlCalibrate)
// now wait until the operation end using command's IsDone property
wait_until_done (LvLensControlCalibrate)
// then possibly verifying if it was successful
read_enum (LvLensControlCalibrationStatus)
// as a convenience, all bound power switches
// can be calibrated at once
exec_cmd (LvLensControlCalibrateAll)
```

In the rest of this section, we'll cover some low level details related to the power switch calibration, such as the individual calibration parameters. If you don't want to bother with those details, you can safely move to the next topic. Note that these low-level details are in “guru” feature visibility level.

Since the calibration is time consuming, it might not be desirable to execute it every time the camera starts. The parameters resulting from the calibration process can be remembered after a successful calibration and next time they can be directly set to the camera. The parameters describing the configuration are:

| | |
|---|---|
| *Lens Control Minus End* | Minimal feedback (bound external ADC) value achievable by driving the power switch with minus polarity (or plus polarity in case of polarity inversion, see below). |
| *Lens Control Plus End* | Maximal feedback (bound external ADC) value achievable by driving the power switch with plus polarity (or minus polarity in case of polarity inversion, see below). |
| *Lens Control Inverted Polarity* | Boolean flag indicating if the lens control external circuit is wired with inverted polarity, meaning that driving the power switch to the plus side decreases the external ADC feedback. |
| *Lens Control Pulse Period* | Optimal determined length of power switch pulse (in µs) which results in feedback value changed by 1. Closely related with *Lens Control Duty Cycle*. |
| *Lens Control Duty Cycle* | Optimal determined duty cycle (in %) which results in feedback value changed by 1. The *Lens Control Pulse Period* and *Lens Control Duty Cycle* parameters define the behavior of the slow motion lens operation used for precise adjustments. The slow motion is achieved by pulsing the power switch, so that each pulse changes feedback value by 1 (assuming the feedback is linear). The pulse period defines the length of the entire pulse, the duty cycle specifies how much of this entire length is the power switch actually active (in %). |

After starting the calibration, the application should wait until the command is finished and then the newly calibrated values can be retrieved. The calibration result can be further affected specifying a *Lens Control Min Calibration Range* (difference between feedback plus and minus ends) that is needed to consider the calibration as successful (valid). When the calibrated feedback range does not reach this minimal value, the *Lens Control Calibration Status* is reported as *Invalid* and the lens control features are disabled for given power switch.

Knowing this additional information, the previous example can be extended as follows:

Simplon

```
LvHDevice hDev; // open the device to get the handle
// (assuming that correct External ADC is bound)
// calibrate the Power Switch 1 with its bound External ADC
// requiring feedback range of at least 20
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvSetInt32 (hDev, LvDevice_LvLensControlMinCalibrationRange, 20);
LvCmdExecute (hDev, LvDevice_LvLensControlCalibrate);
// now wait until the operation end using LvCmdIsDone(),
// then possibly reading and storing the calibrated values
// alternatively, when known, set the values directly,
// without performing the calibration, for example:
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvSetInt32 (hDev, LvDevice_LvLensControlMinusEnd, 42);
LvSetInt32 (hDev, LvDevice_LvLensControlPlusEnd, 169);
LvSetBool (hDev, LvDevice_LvLensControlInvertedPolarity, 0);
LvSetFloat (hDev, LvDevice_LvLensControlPulsePeriod, 100000.0);
LvSetInt32 (hDev, LvDevice_LvLensControlDutyCycle, 9);
```

GEN<i>CAM

```
// (assuming that correct External ADC is bound)
// calibrate the Power Switch 1 with its bound External ADC
// requiring feedback range of at least 20
write_enum (LvPowerSwitchSelector, PowerSwitch1)
write_int (LvLensControlMinCalibrationRange, 20)
exec_cmd (LvLensControlCalibrate)
// now wait until the operation end using command's IsDone property
wait_until_done (LvLensControlCalibrate)
// then possibly reading and storing the calibrated values
// alternatively, when known, set the values directly,
// without performing the calibration, for example:
write_enum (LvPowerSwitchSelector, PowerSwitch1)
write_int (LvLensControlMinusEnd, 42)
write_int (LvLensControlPlusEnd, 169)
write_bool (LvLensControlInvertedPolarity, false)
write_float (LvLensControlPulsePeriod, 100000.0)
write_int (LvLensControlDutyCycle, 9)
```

### Controlling the lens functions

Having initialized the calibration parameters, it is possible to precisely control the position of the respective lens function. Since the interface is generic, the position is not specified in function specific units, but rather as the desired value of the function feedback. The user/application is responsible for mapping the feedback values to the function specific units. The features affecting the lens position control are:

*Lens Control Target Position* — Target position of the function controlled by the selected power switch. The position is specified as the desired value of the function feedback (bound external ADC). The limits for the position are given by the calibrated *Lens Control Minus End* and *Lens Control Plus End* values.

*Lens Control Target Approach* — Controls, how the target position is approached. On some lens types, it might be desirable to reach the target position always from the same time to ensure consistent results. Possible values are:

- *Direct* — Moves the lens always directly to the target position, regardless the current status.
- *FromPlus* — Approaches the target position always from the “plus” side. If the current position is already at the plus side from the target position, it moves directly. If it is in minus side, it first moves slightly to the plus side, then returns back to the target position.

  Note: the “plus” here refers to the plus polarity of the power switch — when the lens is wired with inverted polarity, the plus side of the power switch might correspond with lower feedback values on the bound external ADC.
- *FromMinus* — Approaches the target position always from the “minus” side. If the current position is already at the minus side from the target position, it moves directly. If it is in plus side, it first moves slightly to the minus side, then returns back to the target position.

Note: the “minus” here refers to the minus polarity of the power switch — when the lens is wired with inverted polarity, the minus side of the power switch might correspond with higher feedback values on the bound external ADC.

*Lens Control Nr Slow Steps* — Number of slow steps applied before reaching the target position for improved accuracy. The lens control logic first drives the power switch constantly to almost reach the desired position. Only the final stage is performed by slow motion — pulsing the power switch. The slow motion operation starts when the difference between the current feedback and the target position equals the configured number of slow steps. The pulses are formed according to the calibrated *Lens Control Pulse Period* and *Lens Control Duty Cycle* parameters. Note that this feature is in the “guru” feature visibility level.

*Lens Control Adjust Position* — Drives the power switch to reach the desired target position, using the parameters described above. It uses the feedback coming over the bound external ADC during the operation.

This is the only power switch related command which does not have the “parallel” alternative. Target position of every function (zoom, focus, iris) needs to be adjusted separately.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// (assuming Power Switch Mode is set to Automatic,
// correct External ADC is bound and calibrated)
// adjust the position of the function controlled by Power Switch 1
// so that the bound Extenal ADC gives feedback value 75,
// approach the target always from plus,
// using five final slow motion steps
LvSetEnum (hDev, LvDevice_LvPowerSwitchSelector,
                 LvPowerSwitchSelector_PowerSwitch1);
LvSetEnum (hDev, LvDevice_LvLensControlTargetApproach,
                 LvLensControlTargetApproach_FromPlus);
LvSetInt32 (hDev, LvDevice_LvLensControlNrSlowSteps, 5);
LvSetInt32 (hDev, LvDevice_LvLensControlTargetPosition, 75);
LvCmdExecute (hDev, LvDevice_LvLensControlAdjustPosition);
```

GEN<i>CAM

```
// (assuming Power Switch Mode is set to Automatic,
// correct External ADC is bound and calibrated)
// adjust the position of the function controlled by Power Switch 1
// so that the bound Extenal ADC gives feedback value 75,
// approach the target always from plus,
// using five final slow motion steps
write_enum (LvPowerSwitchSelector, PowerSwitch1)
write_enum (LvLensControlTargetApproach, FromPlus)
write_int (LvLensControlNrSlowSteps, 5)
write_int (LvLensControlTargetPosition, 75)
exec_cmd (LvLensControlAdjustPosition)
```

### 6.14.3.2. High level lens control

For given “known” range of lens types, the cameras will support fully automatic high level control of individual lens functions (zoom, iris, focus), based on the knowledge of the lens properties and a fixed lens control cable wiring. Contact Leutron Vision for more information.

## 6.14.4. Serial Port Control

The CheckSight/CheckSight-II cameras and some models of PicSight-GigE and PicSight-Smart are equipped with a serial port interface to control peripheral devices connected to the camera. The interface supports regular synchronous (command/response) string based communication.

All usual serial communication parameters can be configured:

*Serial Port Baud Rate* — Enumeration adjusting the baud rate. The values range from *2400* (`Baud2400`) to *115200* (`Baud115200`). The default value is *9600* (`Baud9600`).

*Serial Port Parity* — Enumeration adjusting the parity error detection method. Possible values are *None* (default value), *Odd* and *Even*.

*Serial Port Data Bits* — Enumeration adjusting data bits per character. Possible values are *8* (`DataBits8`, the default value) and *7* (`DataBits7`).

*Serial Port Stop Bits* — Enumeration adjusting stop bits per character. Possible values are *1* (`StopBits1`, the default value), *2* (`StopBits2`) and *1.5* (`StopBits1dot5`).

The interface always uses one start bit per character and no handshaking.

After sending the serial command, the camera has to wait for the response sent by the connected peripheral. The response timing is strongly device specific and thus wait operation can be controlled by following two parameters:

*Serial Port Timeout* — Maximal time the camera waits for incoming response characters before reporting the response to the application as floating point value in milliseconds. If no EOT marker is used, the full timeout is always spent before returning the response.

*Serial Port EOT Marker* — End of transmission marker — a string token (frequently just a single character) unequivocally identifying end of the response. Each device might use different characters to mark the end of transmission. Maximal length of the token is 8 characters, but the practically used markers are usually just 1—2 characters.

When specified, the camera observes the received characters and when the marker is encountered in the received buffer, the camera identifies the response as complete, stops waiting and reports the response immediately without completing the timeout.

If the camera receives a burst of characters containing the EOT marker, which is followed by additional characters, it waits little longer to see if another marker will arrive. It then reports the response until the last marker received.

If the EOT marker is not encountered in the response at all, the waiting stops as soon as the timeout expires.

*Serial Port Max Response Length* — Maximal expected response length. As soon as the camera receives the specified number of response characters, it immediately stops waiting and reports the response, regardless the timeout or EOT marker settings.

Value of `0` means that the camera does not wait for any response at all.

The default value is `128`, which is equal to the maximal supported length of the response string — meaning that the default value of this features does not impose any constraints on the expected response length.

The communication itself expects simple string based, synchronous messages (command followed by a single response):

1. Write the command message string to *Serial Port Command String*. Maximal supported command length is 128 characters.

2. Instruct the camera to send the command message to the serial port, executing the *Send Command Over Serial Port* command. The camera will send the characters and will start listening for the response.

3. Wait for completion of the command — wait until the "IsDone" GenICam property of the command yields `true` (in Simplon API this is inspected through `LvCmdIsDone()`). The camera signals the command as "done" when finished waiting for the response, according to the timeout and EOT marker configuration. Important: do not try to read the response before the command is completed, otherwise the communication may fail.

4. Check the command/response operation success — optional but recommended step. The status can be queried using the enumeration feature *Serial Port Command Status*. Possible values are *Success*, *Timeout* (depending on configuration this might signal a problem or not), *Port Busy* (e.g. when used by another application), *Communication Error* (generic), *Frame Error*, *Parity Error*, *Overflow*. If the status reports a failure, reading the response string itself would most probably yield irrelevant result.

5. Read the command response string from *Serial Port Command Response*. Maximal supported response length is 128 characters. Note that issuing a new command will discard any characters in the camera's communication input buffer and the camera will start waiting for a new response.

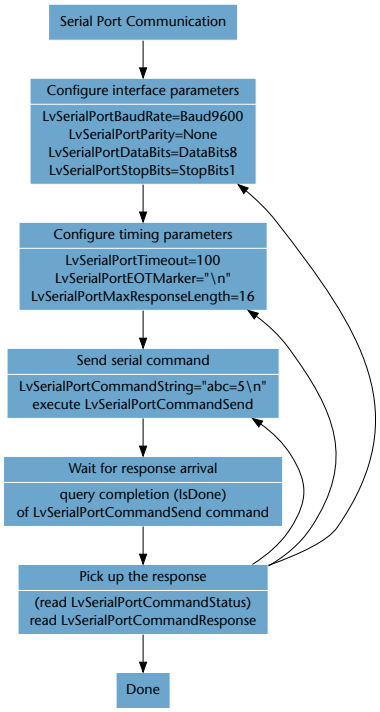


*Figure 6.58. Flow chart: serial port communication*

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure the communication interface parameters
LvSetEnum (hDev, LvDevice_LvSerialPortBaudRate,
                 LvSerialPortBaudRate_Baud9600);
LvSetEnum (hDev, LvDevice_LvSerialPortParity,
                 LvSerialPortParity_None);
LvSetEnum (hDev, LvDevice_LvSerialPortDataBits,
                 LvSerialPortDataBits_DataBits8);
LvSetEnum (hDev, LvDevice_LvSerialPortStopBits,
                 LvSerialPortStopBits_StopBits1);
// configure the response timing parameters
LvSetFloat (hDev, LvDevice_LvSerialPortTimeout, 100.0); // in ms
LvSetString (hDev, LvDevice_LvSerialPortEOTMarker, "\n");
LvSetInt32 (hDev, LvDevice_LvSerialPortMaxResponseLength, 16);
// send simple command 'abc=5\n'
LvSetString (hDev, LvDevice_LvSerialPortCommandString, "abc=5\n");
LvCmdExecute (hDev, LvDevice_LvSerialPortCommandSend);
// wait for the response and pick it up, unless failure is reported
// (wait until the operation end using LvCmdIsDone(),
// or by specifying the timeout in LvCmdExecute() call above)
int32_t EnumVal;
LvGetEnum (hDev, LvDevice_LvSerialPortCommandStatus, &EnumVal);
char StringVal[1024];
LvGetString (hDev, LvDevice_LvSerialPortCommandResponse, StringVal, 1024);
```

GEN<i>CAM

```
// configure the communication interface parameters
write_enum (LvSerialPortBaudRate, Baud9600)
write_enum (LvSerialPortParity, None)
write_enum (LvSerialPortDataBits, DataBits8)
write_enum (LvSerialPortStopBits, StopBits1)
// configure the response timing parameters
write_float (LvSerialPortTimeout, 100.0) // in ms
write_string (LvSerialPortEOTMarker, "\n")
write_int (LvSerialPortMaxResponseLength, 16)
// send simple command 'abc=5\n'
write_string (LvSerialPortCommandString, "abc=5\n")
exec_cmd (LvSerialPortCommandSend)
// wait for the response and pick it up, unless failure is reported
wait_until_done (LvSerialPortCommandSend)
read_enum (LvSerialPortCommandStatus)
read_string (LvSerialPortCommandResponse)
```

# 6.15. Special features

This section discusses special purpose features that do not belong to any other category or that span multiple categories.

*Figure 6.59. Example GUI showing the "special" features*

## 6.15.1. Special purpose triggers

Besides controlling the acquisition (Section 6.6, "Acquisition and trigger control" [p. 124]) and the I/O's (Section 6.7, "Digital I/O, counters and timers" [p. 136]), the external signals can be used to trigger also other specific actions. This can be configured through the "special purpose trigger" features.

The special purpose trigger configuration is very similar to the acquisition trigger features (Section 6.6, "Acquisition and trigger control" [p. 124]):

1. **Select trigger type.** Use the *Special Purpose Trigger Selector* feature to select the trigger type to be configured. In current firmware version, only the *Image Stamps Reset* trigger is available, but more types can be introduced in future.

2. **Trigger source (input line).** Configure the source of the trigger signals (*Special Purpose Trigger Source* feature). It can be a physical input line, such as *Line 1* (see Section 6.7, "Digital I/O, counters and timers" [p. 136], Section 3.7, "Input and output signals" [p. 39], Section 3.8, "Connector and cable description" [p. 44]). Unlike with the acquisition triggers, there is no "Software" option, issuing the trigger through executing the command feature *Generate Special Purpose Trigger* is always possible, regardless the actual trigger source configuration.

   Alternatively, the trigger source can be connected to one of the action commands, such as *Action 1*, if supported by the camera (see Section 6.8, "Action commands control" [p. 147]).

3. **Trigger activation (polarity).** The *Special Purpose Trigger Activation* feature controls which edge of the trigger input signal will be active, ie. which edge will actually ignite the trigger action. Possible values are *Rising Edge* and *Falling Edge*, rising edge being the transition

of signal level from logical `0` to logical `1`. The interpretation of signal levels for different input types (TTL/optocoupler) is discussed in Section 3.7, “Input and output signals” [p. 39]. Not applicable for software triggering.

4. **Configure additional options specific to given trigger.** If a given trigger action can be further controlled through additional features, do it now. For the *Image Stamps Reset* trigger it is possible to specify which stamps should be reset, see below.

5. **Triggering.** The triggers, being generated from external device using a trigger input line or from the application through the *Generate Special Purpose Trigger* command, can be issued at any suitable time.

#### 6.15.1.1. Image stamps reset

The image stamps reset trigger can reset the “stamps” used to label the image buffers and other camera outputs (eg. the asynchronous events). After reset, given stamp starts counting again from zero. Following stamps are available:

Timestamp — Value of the 64-bit timestamp counter maintained by the device. The timestamp is used to label various data outputs provided by the camera, in particular the image buffers (through chunk data, Section 6.11, “Chunk data” [p. 168]) and the asynchronous events (Section 6.12, “Asynchronous events” [p. 173]).

Note that for PicSight-GigE cameras, the timestamp can be controlled also directly through the GigE Vision transport layer features (Section 6.4, “Transport layer control” [p. 102]).

Frame ID — The frame ID stamp serves as an image frame counter (also a 64-bit integer). It is optionally appended to every image buffer through the chunk data (Section 6.11, “Chunk data” [p. 168]).

The frame ID counter starts counting from zero when the camera boots up and keeps counting every acquired frame — until it is explicitly reset or until the value overflows the 64-bit range (in such case it would start counting from zero again).

Note that the counter does not count the image frames transferred to the host PC (the application), but rather all the frames internally acquired by the camera. If the camera boots in free running mode (default behavior), it starts internally acquiring and counting the frames (without transferring them to the application), even if the acquisition was not yet explicitly started by the application. This behaviour is particularly important for the PicSight-Smart cameras, which might be used in a “self-contained” mode, controlled by the smart application without intervention of a host PC.

*Note that the frame ID is in general independent from the “block ID” low-level tags used by the GigE Vision protocol.*

The image stamp reset trigger can be very useful to periodically synchronize the image stamps among multiple cooperating cameras. The trigger can be issued from an independent signal source or from one of the cameras, which works as a “master” in the group — such setup was demonstrated in Section 6.7.8, “Use for inter-camera synchronization” [p. 146].

To activate the image stamp reset trigger, it is first necessary to enable it for the individual stamps — selecting every desired stamp type in *Image Stamp Selector* and then activating the reset trigger functionality for it by setting the *Image Stamp Reset Enable* boolean feature. Each occurrence of the stamp resetting trigger will reset only those stamps that were explicitly enabled, leaving the others intact.

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There's an alternative way that can be used to enable the stamps to be reset in one step — the *Image Stamps Reset Mask* feature, which is a 32-bit bitfield. The least significant bit controls the timestamp, the second bit controls the frame ID.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// configure timestamp reset trigger
LvSetEnum (hDev, LvDevice_LvSpecialPurposeTriggerSelector,
                 LvSpecialPurposeTriggerSelector_ImageStampsReset);
// configure hardware trigger input
LvSetEnum (hDev, LvDevice_LvSpecialPurposeTriggerSource,
                 LvSpecialPurposeTriggerSource_Line2); // Opto input
LvSetEnum (hDev, LvDevice_LvSpecialPurposeTriggerActivation,
                 LvSpecialPurposeTriggerActivation_RisingEdge);
// (or configure trigger over an action command)
LvSetEnum (hDev, LvDevice_LvSpecialPurposeTriggerSource,
                 LvSpecialPurposeTriggerSource_Action2);
// select the stamps to be reset
LvSetEnum (hDev, LvDevice_LvImageStampSelector,
                 LvImageStampSelector_Timestamp);
LvSetBool (hDev, LvDevice_LvImageStampResetEnable, 1);
LvSetEnum (hDev, LvDevice_LvImageStampSelector,
                 LvImageStampSelector_FrameID);
LvSetBool (hDev, LvDevice_LvImageStampResetEnable, 1);
// read back the stamps reset mask as a bitfield
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_LvImageStampsResetMask, &IntVal);
// issue software trigger command to reset the timestamps
// (valid regardless the trigger source configuration)
LvCmdExecute (hDev, LvDevice_LvSpecialPurposeTriggerSoftware);
```

GEN<i>CAM

```
// configure triggered mode
// configure timestamp reset trigger
write_enum (LvSpecialPurposeTriggerSelector, ImageStampsReset)
// configure hardware trigger input
write_enum (LvSpecialPurposeTriggerSource, Line2) // Opto input
write_enum (LvSpecialPurposeTriggerActivation_RisingEdge, RisingEdge)
// (or configure trigger over an action command)
write_enum (LvSpecialPurposeTriggerSource, Action2)
// select the stamps to be reset
write_enum (LvImageStampSelector, Timestamp)
write_bool (LvImageStampResetEnable, true)
write_enum (LvImageStampSelector, FrameID)
write_bool (LvImageStampResetEnable, true)
// read back the stamps reset mask as a bitfield
read_int (LvImageStampsResetMask)
// issue software trigger command to reset the timestamps
// (valid regardless the trigger source configuration)
exec_cmd (LvSpecialPurposeTriggerSoftware)
```

## 6.15.2. Boot switch

The PicSight-GigE cameras are delivered in default configuration fully compatible with the GigE Vision standard. For compatibility with applications based on our legacy software package, LV-

SDS, it is possible to switch them to operating mode supporting also the legacy (pre GigE Vision) communication protocol (see Section 2.5, “GigE Vision compatible and legacy boot modes” [p. 25]).

The operating mode is selected upon camera boot and cannot be changed at runtime. The decision in which operating mode should the camera boot next time is done through enumerated feature *Boot Switch*, which has two options:

*Pure GigE Vision* — Fully compatible with the GigE Vision standard. All new development and feature improvements are done only for this operating mode. This is also the default mode in which the newly manufactured cameras are delivered off the factory.

Note that the legacy communication protocol is not supported in this operating mode and the camera will not even recognized by the legacy LV-SDS software.

*Legacy* — Dual mode supporting both the GigE Vision protocol and the legacy protocol used by LV-SDS. Intended for existing LV-SDS based applications.

Development of this branch is frozen, no new features added, only bugfixes applied. All new designs should be based on the Pure GigE Vision version and the Simplon software interface.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// let the camera start in legacy mode upon next boot
LvSetEnum (hDev, LvDevice_LvBootSwitch, LvBootSwitch_Legacy);
// let the camera start in pure GigE Vision mode upon next boot
LvSetEnum (hDev, LvDevice_LvBootSwitch, LvBootSwitch_PureGEV);
```

GENICAM

```
// let the camera start in legacy mode upon next boot
write_enum (LvBootSwitch, Legacy)
// let the camera start in pure GigE Vision mode upon next boot
write_enum (LvBootSwitch, PureGEV)
```

*The boot mode can also be configured in the HTTP configuration interface, refer to Section 5.3, “HTTP-based configuration” [p. 82].*

## 6.15.3. Watchdog timer control

Some Leutron Vision camera models provide features to control the device's watchdog timer behavior. The watchdog timer is a subsystem allowing to monitor device health. When enabled, the application needs to periodically reset the watchdog timer — the resets serve as the application “heartbeat”. As long as each new heartbeat is issued withing a specified timeout duration, the watchdog stays silent. However, if the watchdog timer expires and the reset command is not issued, the watchdog assumes the application (or entire system) is locked and reboots the camera. The watchdog functionality is implemented in the FPGA, independently from the main camera control, so it remains functional even if the operating systems itself gets locked.

After the camera boots, the watchdog is always inactive. If desired, the application has to enable it explicitly (*Watchdog Enable*), specifying the desired *Watchdog Timeout Duration*. Once enabled, the application is responsible issuing the *Watchdog Reset* signals in period lower than the configured

timeout to prevent the watchdog timeout expiration and device reboot. The watchdog can be disabled again. Furthermore, the current *Watchdog Timer Value* (time remaining until expiration) can be queried.

It is important that the application always disables the watchdog timer whenever it intends to stop updating it regularly, such as when the application shuts down — otherwise the system would be rebooted as soon as the timer expires. The watchdog timer is never disabled automatically.

Finally, the integer *Watchdog Failure Count* provides information about how many watchdog failure reboots happened in the device lifetime.

Note that all the watchdog related features are in “guru” feature visibility level.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// possibly read number of watchdog failures in device's lifetime
LvGetInt32 (hDev, LvDevice_LvWatchdogFailureCount, &IntVal);
// configure and enable the watchdog timer...
LvSetFloat (hDev, LvDevice_LvWatchdogTimerDuration, 20.0); // in seconds
LvSetBool (hDev, LvDevice_LvWatchdogEnable, 1);
// ...and immediatelly start feeding it with regular reset signals
LvCmdExecute (hDev, LvDevice_LvWatchdogTimerReset);
// the actual value of the watchdog timer can be queried
double FloatVal;
LvGetFloat (hDev, LvDevice_LvWatchdogTimerValue, &FloatVal);
// when not needed any more, disable the watchdog timer
LvSetBool (hDev, LvDevice_LvWatchdogEnable, 0);
```

GEN<i>CAM

```
// possibly read number of watchdog failures in device's lifetime
read_int (LvWatchdogFailureCount)
// configure and enable the watchdog timer...
write_float (LvWatchdogTimerDuration, 20.0) // in seconds
write_bool (LvWatchdogEnable, true)
// ...and immediatelly start feeding it with regular reset signals
exec_cmd (LvWatchdogTimerReset)
// the actual value of the watchdog timer can be queried
read_float (LvWatchdogTimerValue)
// when not needed any more, disable the watchdog timer
write_bool (LvWatchdogEnable, false)
```

## 6.16. Smart application control

The Smart Application Features category contains features dedicated for control of the smart applications running at PicSight-Smart.

*Figure 6.60. Example GUI showing the smart application features*

The PicSight-Smart cameras (see Section 6.2, “Camera classes” [p. 97], Section 3.10, “PicSight-Smart architecture” [p. 48]) provide means for programming embedded applications running directly at the camera. The smart application programming is beyond the scope of this manual (refer to PicSight-Smart Library API documentation). We will, however, briefly discuss the generic features controlling the smart application behavior.

The feature tree of the PicSight-Smart cameras contains a category called “Smart Application Features”, which contains some generic features that can be used to control the smart application running at the camera. It is up to the smart application itself which of them will be enabled and how they will be used (which smart application function they will control). Using these generic features, the smart application can be directly interfaced from any GigE Vision and GenICam compatible software, including the Simplon API.

Smart application programmers should refer to the PicSight-Smart Library API documentation to learn how to enable individual smart application control features and how to interact with the feature tree.

Users controlling the smart application running on a PicSight-Smart camera should refer to the documentation of that respective smart application (usually designed by a 3rd party) to learn the mapping of the individual generic features to the particular smart application functions.

*The smart application can optionally “lock” access to camera configuration through the regular features and allow control solely through the dedicated features in the Smart Application Features category. In such case the regular feature tree is not accessible, being limited just to the few most essential features required by the GigE Vision standard, even those just read-only.*

## 6.16.1. Basic application information and control

The smart application execution can be controlled through several basic features:

*Smart Application ID*
String identifier of the smart application currently running at the camera. If no smart application is running, this feature will report string `Streaming`. The same string will be reported on regular PicSight-GigE cameras.

*Smart Application Path*
Path to the application to be started through the *Start Smart Application* command. The required path will be specified in each corresponding smart application documentation.

*Start Smart Application*
Start the smart application specified in *Smart Application Path*. Since the smart application takes control over the camera, the entire feature tree becomes invalid and should be released and reopened again.

*Send Smart Application Exit Event*
Sends exit event to the currently running smart application. The application will finish execution at closest suitable point. Since the smart application releases control over the camera,

the entire feature tree becomes invalid and should be released and reopened again.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// read the application identifier
char StringVal[1024];
LvGetString (hDev, LvDevice_LvSmartAppID, StringVal, 1024);
// start the smart application specified by its path
// (the entire feature tree will be invalidated by this action)
LvSetString (hDev, LvDevice_LvSmartAppPath, "MySmartAppPath");
LvCmdExecute (hDev, LvDevice_LvSmartAppStart);
// send the exit event to the running smart application
// (the entire feature tree will be invalidated by this action)
LvCmdExecute (hDev, LvDevice_LvSmartAppExitEvent);
```

GEN<i>CAM

```
// read the application identifier
read_string (LvSmartAppID)
// start the smart application specified by its path
// (the entire feature tree will be invalidated by this action)
write_string (LvSmartAppPath, "MySmartAppPath")
exec_cmd (LvSmartAppStart)
// send the exit event to the running smart application
// (the entire feature tree will be invalidated by this action)
exec_cmd (LvSmartAppExitEvent)
```

## 6.16.2. Generic integer registers

The interface provides 32 signed integer features (*Signed Integer 1* to *Signed Integer 32*) and 32 unsigned integer features (*Unsigned Integer 1* to *Unsigned Integer 32*). The smart application decides which of them will be enabled, what will be their range and access status (read-only or read-write).

Simplon

```
LvHDevice hDev; // open the device to get the handle
// write 42 to unsigned integer #7
LvSetInt32 (hDev, LvDevice_LvSmartAppUint7, 42);
// read value of signed integer #4
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_LvSmartAppInt4, &IntVal);
```

GEN<i>CAM

```
// write 42 to unsigned integer #7
write_int (LvSmartAppUint7, 42)
LvSetInt32 (hDev, LvDevice_LvSmartAppUint7, 42);
// read value of signed integer #4
read_int (LvSmartAppInt4)
```

### 6.16.3. ASCII commands

The smart application can be controlled through simple synchronous (command/response) ASCII string commands. The user/application will specify the string command for the application and start its execution explicitly. The smart application will provide feedback through a string response and an integer return code. The communication procedure is simple:

1. Write the command message string to *ASCII Command String*. Maximal supported command length is 128 characters.

2. Instruct the smart application to apply the command, executing the *ASCII Command Execute* command feature. The smart application will start executing the operation bound to the command and when finished, it will provide the feedback.

3. Wait for completion of the command — wait until the "IsDone" GenICam property of the command yields `true` (in Simplon API this is inspected through `LvCmdIsDone()`). The smart application signals the command as "done" when the operation is finished. Important: do not try to read the response and return code before the command is completed, otherwise the communication may fail.

4. Read the command response string from *ASCII Command Response* and the integer return code from *ASCII Command Return Code*. Maximal supported response length is 128 characters..

Simplon

```
LvHDevice hDev; // open the device to get the handle
// send simple command 'foobar'
LvSetString (hDev, LvDevice_LvSmartAppAsciiCmdString, "foobar");
LvCmdExecute (hDev, LvDevice_LvSmartAppAsciiCmdExecute);
// wait for the response + return code and pick it up
// (wait until the operation end using LvCmdIsDone(),
// or by specifying the timeout in LvCmdExecute() call above)
char StringVal[1024];
LvGetString (hDev, LvDevice_LvSmartAppAsciiCmdFeedback, StringVal, 1024);
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_LvSmartAppAsciiCmdRetCode, &IntVal);
```

GEN<i>CAM

```
// send simple command 'foobar'
write_string (LvSmartAppAsciiCmdString, "foobar")
exec_cmd (LvSmartAppAsciiCmdExecute)
// wait for the response and pick it up
wait_until_done (LvSmartAppAsciiCmdExecute)
read_string (LvSmartAppAsciiCmdFeedback)
read_int (LvSmartAppAsciiCmdRetCode)
```

## 6.17. Feature summary

The following table provides condensed summary of all the features existing among all our camera families. Some of the features are only supported by certain camera families, some of them even just by certain few camera models. The range of allowed values might differ.

For detailed explanation of the purpose of each feature group and their dependencies, refer to previous sections in this chapter. To learn availability of a feature on a particular camera model, refer to the model datasheet or contact our sales department.

| Name | Description |
|---|---|
| **Feature category: Device Control** , refer to Section 6.3, “Information about the camera” [p. 98] | |
| `DeviceVendorName`<br>*GUI name: Vendor Name* | Name of the manufacturer of the device<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceModelName`<br>*GUI name: Model Name* | Model name of the device<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceManufacturerInfo`<br>*GUI name: Manufacturer Info* | Manufacturer information about the device<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceVersion`<br>*GUI name: Device Hardware Version* | Version of the device<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceFirmwareVersion`<br>*GUI name: Device Firmware Version* | Version of the device firmware<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `LvRecoveryFirmwareVersion`<br>*GUI name: Recovery Firmware Version* | Indicates the version of the firmware and software to which the device would recover<br>Type: string<br>GUI visibility: guru<br>Read-only feature |
| `DeviceID`<br>*GUI name: Device ID* | Device identifier (serial number)<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `DeviceUserID`<br>*GUI name: Device User ID* | User-programmable device identifier<br>Type: string<br>GUI visibility: beginner |
| `LvSensorID`<br>*GUI name: Sensor ID* | Serial number of the sensor board<br>Type: string<br>GUI visibility: guru<br>Read-only feature |

| Name | Description |
|---|---|
| `LvGrabberID`<br>*GUI name: Grabber ID* | Serial number of the grabber board<br>Type: string<br>GUI visibility: guru<br>Read-only feature |
| `DeviceScanType`<br>*GUI name: Device Scan Type* | Scan type of the sensor.<br>Type: enumeration<br>Possible values: `Areascan`<br>GUI visibility: expert<br>Read-only feature |
| `DeviceRegistersStreamingStart`<br>*GUI name: Device Registers Streaming Start* | Announces start of register streaming<br>Type: command<br>GUI visibility: guru |
| `DeviceRegistersStreamingEnd`<br>*GUI name: Device Registers Streaming End* | Announces end of register streaming<br>Type: command<br>GUI visibility: guru |
| `DeviceRegistersCheck`<br>*GUI name: Device Registers Check* | Requests validation of the register set<br>Type: command<br>GUI visibility: expert |
| `DeviceRegistersValid`<br>*GUI name: Device Registers Valid* | Result of registers validity check<br>Type: bool<br>GUI visibility: expert<br>Read-only feature |
| `DeviceReset`<br>*GUI name: Reset Device* | Resets the device<br>Type: command<br>GUI visibility: guru |
| `DeviceClockSelector`<br>*GUI name: Clock Selector* | Selects a device clock frequency<br>Type: enumeration<br>Possible values: `SensorDigitization`<br>GUI visibility: expert |
| `DeviceClockFrequency`<br>[`DeviceClockSelector`]<br>*GUI name: Clock Frequency* | Frequency of the selected clock<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: Hz |
| `DeviceTemperatureSelector`<br>*GUI name: Temperature Selector* | Selects a temperature measurement location<br>Type: enumeration<br>Possible values: `Sensor`, `Mainboard`<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `DeviceTemperature`<br>[`DeviceTemperatureSelector`]<br>*GUI name: Temperature* | Current temperature at the selected location<br>Type: float<br>GUI visibility: expert<br>Read-only feature<br>Unit: C |
| `LvDeviceUpTime`<br>*GUI name: Up Time* | Current up-time of the device<br>Type: integer<br>GUI visibility: expert<br>Unit: ms |
| `LvDeviceType`<br>*GUI name: Device Type* | Indicates the basic type of the device<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `DeviceSFNCVersionMajor`<br>*GUI name: Device SFNC Version Major* | Major version of SFNC standard used by the device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceSFNCVersionMinor`<br>*GUI name: Device SFNC Version Minor* | Minor version of SFNC standard used by the device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceSFNCVersionSubMinor`<br>*GUI name: Device SFNC Version Subminor* | Sub-minor version of SFNC standard used by the device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| **Feature category: Image Format Control** , refer to Section 6.5, “Image format” [p. 107] | |
| `SensorWidth`<br>*GUI name: Sensor Width* | Effective width of the sensor in pixels.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: px |
| `SensorHeight`<br>*GUI name: Sensor Height* | Effective height of the sensor in pixels.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: px |

| Name | Description |
|---|---|
| `WidthMax`<br>*GUI name: Max Width* | Maximum width of the image.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: px |
| `HeightMax`<br>*GUI name: Max Height* | Maximum height of the image.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: px |
| `Width`<br>*GUI name: Width* | Image width provided by the device<br>Type: integer<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets<br>Unit: px |
| `Height`<br>*GUI name: Height* | Image height provided by the device<br>Type: integer<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets<br>Unit: px |
| `OffsetX`<br>*GUI name: X Offset* | Horizontal offset from the origin of the AOI.<br>Type: integer<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets<br>Unit: px |
| `OffsetY`<br>*GUI name: Y Offset* | Vertical offset from the origin of the AOI.<br>Type: integer<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets<br>Unit: px |

| Name | Description |
|---|---|
| `PixelFormat`<br>*GUI name: Pixel Format* | Pixel format provided by the device<br>Type: enumeration<br>Possible values: `Mono8`, `Mono8Signed`, `Mono10`, `Mono10Packed`, `Mono12`, `Mono12Packed`, `Mono16`, `BayerGR8`, `BayerRG8`, `BayerGB8`, `BayerBG8`, `BayerGR10`, `BayerRG10`, `BayerGB10`, `BayerBG10`, `BayerGR12`, `BayerRG12`, `BayerGB12`, `BayerBG12`, `RGB8Packed`, `BGR8Packed`, `RGBA8Packed`, `BGRA8Packed`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `BinningHorizontal`<br>*GUI name: Horizontal Binning* | Horizontal binning factor<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `BinningVertical`<br>*GUI name: Vertical Binning* | Vertical binning factor<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `DecimationHorizontal`<br>*GUI name: Horizontal Decimation* | Horizontal decimation factor<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `DecimationVertical`<br>*GUI name: Vertical Decimation* | Vertical decimation factor<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvAOIMode`<br>*GUI name: AOI Mode* | Mode of controlling the area of interest<br>Type: enumeration<br>Possible values: `Automatic`, `ClipOnTransfer`, `Manual`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |

| Name | Description |
|---|---|
| `LvReadoutWidth`<br>*GUI name: Readout Width* | Width of the sensor-side area of interest in pixels<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: px |
| `LvReadoutHeight`<br>*GUI name: Readout Height* | Height of the sensor-side area of interest in pixels<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: px |
| `LvReadoutOffsetX`<br>*GUI name: Readout X Offset* | X offset (left offset) of the sensor-side area of interest in pixels<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: px |
| `LvReadoutOffsetY`<br>*GUI name: Readout Y Offset* | Y offset (top offset) of the sensor-side area of interest in pixels<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: px |
| `LvVariablePayloadSize`<br>*GUI name: Variable Payload Size* | Flag switching on the variable payload size mode<br>Type: bool<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| **Feature category: Acquisition Control** , refer to Section 6.6, “Acquisition and trigger control” [p. 124] | |
| `AcquisitionMode`<br>*GUI name: Acquisition Mode* | Acquisition mode of the device<br>Type: enumeration<br>Possible values: `SingleFrame`, `MultiFrame`, `Continuous`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `AcquisitionStart`<br>*GUI name: Acquisition Start* | Starts image acquisition<br>Type: command<br>GUI visibility: beginner |

| Name | Description |
|---|---|
| `AcquisitionStop`<br>*GUI name: Acquisition Stop* | Stops image acquisition<br>Type: command<br>GUI visibility: beginner |
| `AcquisitionArm`<br>*GUI name: Acquisition Arm* | Arms the camera for acquisition start<br>Type: command<br>GUI visibility: expert |
| `TriggerSelector`<br>*GUI name: Trigger Selector* | Selects the type of trigger to configure<br>Type: enumeration<br>Possible values: `FrameStart`<br>GUI visibility: beginner |
| `TriggerMode`<br>[`TriggerSelector`]<br>*GUI name: Trigger Mode* | Controls if the selected trigger is active<br>Type: enumeration<br>Possible values: `Off`, `On`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `TriggerSoftware`<br>[`TriggerSelector`]<br>*GUI name: Generate Software Trigger* | Generates a software trigger<br>Type: command<br>GUI visibility: beginner |
| `TriggerSource`<br>[`TriggerSelector`]<br>*GUI name: Trigger Source* | Signal source for the selected trigger<br>Type: enumeration<br>Possible values: `Line1`, `Line2`, `Line3`, `Line4`, `Line5`, `Line6`, `Line7`, `Line8`, `Line17`, `Line18`, `Line19`, `Line20`, `Line21`, `Line22`, `Line23`, `Line24`, `Action1`, `Action2`, `Action3`, `Action4`, `Action5`, `Action6`, `Action7`, `Action8`, `Software`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `TriggerActivation`<br>[`TriggerSelector`]<br>*GUI name: Trigger Activation* | Activation mode of the trigger.<br>Type: enumeration<br>Possible values: `RisingEdge`, `FallingEdge`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `TriggerDelay`<br>[`TriggerSelector`]<br>*GUI name: TriggerDelay* | Trigger delay in microseconds<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: us |

| Name | Description |
|---|---|
| `TriggerDivider`<br>[`TriggerSelector`]<br>*GUI name: Trigger Divider* | Trigger divider<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvTriggerCaching`<br>[`TriggerSelector`]<br>*GUI name: Trigger Caching* | Caching mode for the selected trigger<br>Type: enumeration<br>Possible values: `Cache`, `Drop`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `ExposureMode`<br>*GUI name: Exposure Mode* | Exposure (shutter) mode<br>Type: enumeration<br>Possible values: `Timed`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `LvLongRangeExposureMode`<br>*GUI name: Long Range Exposure Mode* | Switches to mode with wider range of exposure times<br>Type: bool<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `LvGlobalResetMode`<br>*GUI name: Global Reset Mode* | Switches to mode with wider range of exposure times<br>Type: bool<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `ExposureTime`<br>*GUI name: Exposure Time* | Exposure time in microseconds<br>Type: float<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets<br>Unit: us |
| `ExposureAuto`<br>*GUI name: Automatic Exposure* | Selects the automatic exposure mode<br>Type: enumeration<br>Possible values: `Off`, `Once`, `Continuous`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |

| Name | Description |
|---|---|
| `LvAcquisitionFrameRateControlMode`<br>*GUI name: Acquisition Frame Rate Control* | Switches the acquisition frame rate control on or off<br>Type: enumeration<br>Possible values: `Off`, `On`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `AcquisitionFrameRate`<br>*GUI name: Acquisition Frame Rate* | Acquisition frame rate in frames per second (Hz)<br>Type: float<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets<br>Unit: Hz |
| **Feature category: Digital I/O Control** , refer to Section 6.7, "Digital I/O, counters and timers" [p. 136] | |
| `LineSelector`<br>*GUI name: Line Selector* | Selects the I/O line for querying and configuration<br>Type: enumeration<br>Possible values: `Line1`, `Line2`, `Line3`, `Line4`, `Line5`, `Line6`, `Line7`, `Line8`, `Line9`, `Line10`, `Line11`, `Line12`, `Line13`, `Line14`, `Line15`, `Line16`, `Line17`, `Line18`, `Line19`, `Line20`, `Line21`, `Line22`, `Line23`, `Line24`, `Line25`, `Line26`, `Line27`, `Line28`, `Line29`, `Line30`, `Line31`, `Line32`<br>GUI visibility: expert |
| `LineMode`<br>[`LineSelector`]<br>*GUI name: Line Mode* | Line mode (input or output)<br>Type: enumeration<br>Possible values: `Input`, `Output`<br>GUI visibility: expert<br>Read-only feature |
| `LineFormat`<br>[`LineSelector`]<br>*GUI name: Line Format* | Sets the electrical configuration of the selected line<br>Type: enumeration<br>Possible values: `NoConnect`, `TriState`, `TTL`, `LVDS`, `RS422`, `OptoCoupled`<br>GUI visibility: expert<br>Read-only feature |

| Name | Description |
|---|---|
| `LineSource`<br>[`LineSelector`]<br>*GUI name: Line Source* | Internal signal driving the line's ouptut<br>Type: enumeration<br>Possible values: `Off`, `ExposureActive`, `Timer1Active`, `Timer2Active`, `Timer3Active`, `Timer4Active`, `UserOutput1`, `UserOutput2`, `UserOutput3`, `UserOutput4`, `UserOutput5`, `UserOutput6`, `UserOutput7`, `UserOutput8`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LineInverter`<br>[`LineSelector`]<br>*GUI name: Line Inverter* | Inverts the signal<br>Type: bool<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvLineDebounceDuration`<br>[`LineSelector`]<br>*GUI name: Line Debounce Duration* | Duration of line debounce period<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: us |
| `LineStatus`<br>[`LineSelector`]<br>*GUI name: Line Status* | Status of the selected line<br>Type: bool<br>GUI visibility: expert<br>Read-only feature |
| `LineStatusAll`<br>*GUI name: Line Status All* | Status of i/o lines<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `UserOutputSelector`<br>*GUI name: User Output Selector* | Selects the user output for querying and configuration<br>Type: enumeration<br>Possible values: `UserOutput1`, `UserOutput2`, `UserOutput3`, `UserOutput4`, `UserOutput5`, `UserOutput6`, `UserOutput7`, `UserOutput8`<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `UserOutputValue`<br>[`UserOutputSelector`]<br>*GUI name: User Output Value* | Status of the selected user output<br>Type: bool<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `UserOutputValueAll`<br>*GUI name: User Output Value All* | Status of user outputs<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `UserOutputValueAllMask`<br>*GUI name: User Output Value All Mask* | Mask for the User Output Value All bitfield<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| **Feature category: Counter and Timer Control** , refer to Section 6.7, “Digital I/O, counters and timers” [p. 136] | |
| `CounterSelector`<br>*GUI name: Counter Selector* | Selects which counter to configure<br>Type: enumeration<br>Possible values: `Counter1`, `Counter2`, `Counter3`, `Counter4`<br>GUI visibility: expert |
| `LvCounterMode`<br>[`CounterSelector`]<br>*GUI name: Counter Mode* | Selects working mode of the selected counter.<br>Type: enumeration<br>Possible values: `Autoreset`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `CounterEventSource`<br>[`CounterSelector`]<br>*GUI name: Counter Event Source* | Signal incrementing the counter<br>Type: enumeration<br>Possible values: `Off`, `FrameTrigger`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `CounterReset`<br>[`CounterSelector`]<br>*GUI name: Counter Reset* | Resets the selected counter<br>Type: command<br>GUI visibility: expert |
| `CounterValue`<br>[`CounterSelector`]<br>*GUI name: Counter Value* | Current value of the selected counter<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |

| Name | Description |
|---|---|
| `CounterDuration`<br>[`CounterSelector`]<br>*GUI name: Counter Duration* | Duration (number of events) for the selected counter<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `TimerSelector`<br>*GUI name: Timer Selector* | Selects which timer to configure<br>Type: enumeration<br>Possible values: `Timer1`, `Timer2`, `Timer3`, `Timer4`<br>GUI visibility: expert |
| `TimerDuration`<br>[`TimerSelector`]<br>*GUI name: Timer Duration* | Duration of the selected timer<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: us |
| `TimerDelay`<br>[`TimerSelector`]<br>*GUI name: Timer Delay* | Delay for the selected timer<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: us |
| `TimerTriggerSource`<br>[`TimerSelector`]<br>*GUI name: Timer Trigger Source* | Signal activating the timer<br>Type: enumeration<br>Possible values: `Off`, `FrameTrigger`, `Counter1End`, `Counter2End`, `Counter3End`, `Counter4End`, `UserOutput1`, `UserOutput2`, `UserOutput3`, `UserOutput4`, `UserOutput5`, `UserOutput6`, `UserOutput7`, `UserOutput8`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| **Feature category: Action Control** , refer to Section 6.8, “Action commands control” [p. 147] | |
| `ActionDeviceKey`<br>*GUI name: Action Device Key* | Provides the device key that allows the device to check the validity of action commands.<br>Type: integer<br>GUI visibility: guru |
| `ActionSelector`<br>*GUI name: Action Selector* | Selects to which action signal further action settings apply.<br>Type: integer<br>GUI visibility: guru |

| Name | Description |
|---|---|
| ActionGroupKey<br>[ActionSelector]<br>*GUI name: Action Group Key* | Provides the key that the device will use to validate the action on reception of the action protocol message.<br>Type: integer<br>GUI visibility: guru |
| ActionGroupMask<br>[ActionSelector]<br>*GUI name: Action Group Mask* | Provides the mask that the device will use to validate the action on reception of the action protocol message.<br>Type: integer<br>GUI visibility: guru |
| **Feature category: Special Features** , refer to Section 6.15, "Special features" [p. 196] | |
| LvSpecialPurposeTriggerSelector<br>*GUI name: Special Purpose Trigger Selector* | Selects the special purpose trigger type to configure<br>Type: enumeration<br>Possible values: ImageStampsReset<br>GUI visibility: expert |
| LvSpecialPurposeTriggerSource<br>[LvSpecialPurposeTriggerSelector]<br>*GUI name: Special Purpose Trigger Source* | Signal source for the selected trigger<br>Type: enumeration<br>Possible values: Off, Line1, Line2, Line3, Line4, Line5, Line6, Line7, Line8, Line17, Line18, Line19, Line20, Line21, Line22, Line23, Line24, Action1, Action2, Action3, Action4, Action5, Action6, Action7, Action8<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| LvSpecialPurposeTriggerActivation<br>[LvSpecialPurposeTriggerSelector]<br>*GUI name: Special Purpose Trigger Activation* | Activation mode of the trigger.<br>Type: enumeration<br>Possible values: RisingEdge, FallingEdge<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| LvSpecialPurposeTriggerSoftware<br>[LvSpecialPurposeTriggerSelector]<br>*GUI name: Generate Special Purpose Trigger* | Generates a software trigger<br>Type: command<br>GUI visibility: expert |
| LvImageStampsResetMask<br>*GUI name: Image Stamps Reset Mask* | A single bitfield that selects which features will be reset by the image stamp reset trigger<br>Type: integer<br>GUI visibility: guru |
| LvImageStampSelector<br>*GUI name: Image Stamp Selector* | Selects an image stamp type for configuration<br>Type: enumeration<br>Possible values: Timestamp, FrameID<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvImageStampResetEnable`<br>[`LvImageStampSelector`]<br>*GUI name: Image Stamp Reset Enable* | Enables/disables the reset trigger functionality for the selected image stamp type<br>Type: bool<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvBootSwitch`<br>*GUI name: Boot Switch* | Selects the firmware type to load on next boot<br>Type: enumeration<br>Possible values: `PureGEV`, `Legacy`<br>GUI visibility: guru |
| `LvBayerDecoderAlgorithm`<br>*GUI name: Bayer Decoder Algorithm* | Selects the Bayer decoder algorithm<br>Type: enumeration<br>Possible values: `VariableGradient`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvBayerDecoderThreshold`<br>*GUI name: Bayer Decoder Threshold* | Sets the Bayer decoder threshold<br>Type: float<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets |
| `LvWatchdogEnable`<br>*GUI name: Watchdog Enable* | Enables the watchdog reset function<br>Type: bool<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets |
| `LvWatchdogTimerDuration`<br>*GUI name: Watchdog Timer Duration* | When watchdog is enabled, the device reboots when the timeout specified expires<br>Type: float<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets<br>Unit: s |
| `LvWatchdogTimerValue`<br>*GUI name: Watchdog Timer Value* | Current watchdog timer value - reports the current value, after which the timer expires<br>Type: float<br>GUI visibility: guru<br>Read-only feature<br>Unit: s |
| `LvWatchdogTimerReset`<br>*GUI name: Watchdog Timer Reset* | Resets the watchdog timer, the watchdog starts counting the specified timeout again<br>Type: command<br>GUI visibility: guru |

| Name | Description |
|---|---|
| `LvWatchdogFailed`<br>*GUI name: Watchdog Failed* | Signals that the last device reboot was initiated by the watchdog function<br>Type: bool<br>GUI visibility: guru |
| `LvWatchdogFailureCount`<br>*GUI name: Watchdog Failure Count* | Number of watchdog failures (reboots) in camera's lifetime<br>Type: integer<br>GUI visibility: guru |
| **Feature category: Analog Control** , refer to Section 6.9, “Analog controls” [p. 149] | |
| `GainSelector`<br>*GUI name: Gain Selector* | Selects which gain type to configure<br>Type: enumeration<br>Possible values: `All`, `AnalogAll`, `DigitalAll`<br>GUI visibility: beginner |
| `Gain`<br>[`GainSelector`]<br>*GUI name: Gain* | Gain value for the selected gain type<br>Type: float<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets<br>Unit: dB |
| `GainAuto`<br>[`GainSelector`]<br>*GUI name: Automatic Gain* | Automatic gain mode<br>Type: enumeration<br>Possible values: `Off`, `Once`, `Continuous`<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `BlackLevelSelector`<br>*GUI name: Black Level Selector* | Selects which black level type to configure<br>Type: enumeration<br>Possible values: `All`<br>GUI visibility: expert |
| `BlackLevel`<br>[`BlackLevelSelector`]<br>*GUI name: Black Level* | Black level value<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: DN |
| `BlackLevelAuto`<br>[`BlackLevelSelector`]<br>*GUI name: Automatic Black Level* | Automatic black level mode<br>Type: enumeration<br>Possible values: `Off`, `Once`, `Continuous`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |

| Name | Description |
|---|---|
| **Feature category: Color Transformation Control** , refer to Section 6.10, “Luminance and color handling” [p. 156] | |
| `ColorTransformationSelector`<br>*GUI name: Color Transformation Selector* | Selects which color transformation module is controlled by the color transformation features.<br>Type: enumeration<br>Possible values: `RGBtoRGB`<br>GUI visibility: expert |
| `ColorTransformationEnable`<br>[`ColorTransformationSelector`]<br>*GUI name: Color Transformation Enable* | Activates the selected Color Transformation module<br>Type: bool<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `ColorTransformationValueSelector`<br>[`ColorTransformationSelector`]<br>*GUI name: Color Transformation Value Selector* | Selects the color transformation matrix entry<br>Type: enumeration<br>Possible values: `Gain00`, `Gain01`, `Gain02`, `Gain10`, `Gain11`, `Gain12`, `Gain20`, `Gain21`, `Gain22`<br>GUI visibility: expert |
| `ColorTransformationValue`<br>[`ColorTransformationValueSelector`]<br>*GUI name: Color Transformation Entry Value* | Value of the selected color transformation matrix entry<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| **Feature category: External Device Control** , refer to Section 6.14, “External device control” [p. 182] | |
| `LvExternalDeviceControlMode`<br>*GUI name: External Device Control Mode* | Selects the operation mode of external device control.<br>Type: enumeration<br>Possible values: `Custom`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvExternalADCSelector`<br>*GUI name: External ADC Selector* | External ADC to configure.<br>Type: enumeration<br>Possible values: `ExternalADC1`, `ExternalADC2`, `ExternalADC3`, `ExternalADC4`<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvExternalADCValue`<br>[`LvExternalADCSelector`]<br>*GUI name: External ADC Value* | Value of the selected external ADC<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: DN |
| `LvPowerSwitchCurrentAction`<br>*GUI name: Power Switch Current Action* | Action currently performed by a power switch<br>Type: enumeration<br>Possible values: `Idle`, `Pulse`, `Calibrate`, `AdjustPosition`, `Drive`<br>GUI visibility: expert<br>Read-only feature |
| `LvPowerSwitchSelector`<br>*GUI name: Power Switch Selector* | Power switch to configure.<br>Type: enumeration<br>Possible values: `PowerSwitch1`, `PowerSwitch2`, `PowerSwitch3`, `PowerSwitch4`<br>GUI visibility: expert |
| `LvPowerSwitchBoundADC`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Power Switch Bound ADC* | Binds an external ADC to the power switch<br>Type: enumeration<br>Possible values: `None`, `ExternalADC1`, `ExternalADC2`, `ExternalADC3`, `ExternalADC4`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvPowerSwitchDrive`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Power Switch Drive* | Drives the selected power switch with desired polarity<br>Type: enumeration<br>Possible values: `Off`, `Plus`, `Minus`<br>GUI visibility: expert |
| `LvPowerSwitchPulseDuration`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Power Switch Pulse Duration* | Power switch pulse duration in microseconds<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: us |
| `LvPowerSwitchPulsePlus`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Power Switch Pulse Plus* | Pulses the selected power switch with plus polarity<br>Type: command<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvPowerSwitchPulseMinus`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Power Switch Pulse Minus* | Pulses the selected power switch with minus polarity<br>Type: command<br>GUI visibility: expert |
| `LvLensControlMinCalibrationRange`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Min Calibration Range* | Minimum ADC range required for calibration<br>Type: integer<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets |
| `LvLensControlCalibrate`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Calibrate* | Starts automatic calibration<br>Type: command<br>GUI visibility: expert |
| `LvLensControlCalibrationStatus`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Calibration Status* | Reports current calibration status of the selected power switch and its bound ADC<br>Type: enumeration<br>Possible values: `Invalid`, `Valid`<br>GUI visibility: expert<br>Read-only feature |
| `LvLensControlMinusEnd`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Minus End* | Calibrated minimal ADC achievable by driving the power switch's with minus polarity (plus if the polarity is inverted)<br>Type: integer<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets |
| `LvLensControlPlusEnd`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Plus End* | Calibrated maximal ADC achievable by driving the power switch's with plus polarity (minus if the polarity is inverted)<br>Type: integer<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets |
| `LvLensControlInvertedPolarity`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Inverted Polarity* | Indicates if the lens is wired with inverted polarity<br>Type: bool<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets |
| `LvLensControlPulsePeriod`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Pulse Period* | Calibrated slow motion pulse period for the selected power switch, in microsesonds<br>Type: float<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets<br>Unit: us |

| Name | Description |
|---|---|
| `LvLensControlDutyCycle`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Duty Cycle* | Calibrated slow motion duty cycle on the power switch<br>Type: integer<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets<br>Unit: % |
| `LvLensControlTargetApproach`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Target Approach* | Selects how the target lens position should be approached<br>Type: enumeration<br>Possible values: `Direct`, `FromPlus`, `FromMinus`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvLensControlNrSlowSteps`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Nr Slow Steps* | Number of slow steps before the target position<br>Type: integer<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets |
| `LvLensControlTargetPosition`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Target Position* | Target lens position<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvLensControlAdjustPosition`<br>[`LvPowerSwitchSelector`]<br>*GUI name: Lens Control Adjust Position* | Adjusts the target lens position<br>Type: command<br>GUI visibility: expert |
| `LvLensControlCalibrateAll`<br>*GUI name: Lens Control Calibrate All* | Starts automatic calibration<br>Type: command<br>GUI visibility: expert |
| `LvSerialPortBaudRate`<br>*GUI name: Serial Port Baud Rate* | Baud rate used for the serial port communication<br>Type: enumeration<br>Possible values: `Baud2400`, `Baud4800`, `Baud9600`, `Baud14400`, `Baud19200`, `Baud38400`, `Baud57600`, `Baud115200`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |

| Name | Description |
|---|---|
| `LvSerialPortParity`<br>*GUI name: Serial Port Parity* | Parity used for the serial port communication<br>Type: enumeration<br>Possible values: `None`, `Odd`, `Even`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvSerialPortDataBits`<br>*GUI name: Serial Port Data Bits* | Data bits per character for the serial port communication<br>Type: enumeration<br>Possible values: `DataBits7`, `DataBits8`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvSerialPortStopBits`<br>*GUI name: Serial Port Stop Bits* | Stop bits per character for the serial port communication<br>Type: enumeration<br>Possible values: `StopBits1`, `StopBits1dot5`, `StopBits2`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvSerialPortTimeout`<br>*GUI name: Serial Port Timeout* | Timeout value used to finish waiting for command response<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: ms |
| `LvSerialPortEOTMarker`<br>*GUI name: Serial Port EOT Marker* | Short string (or single character) marking end of transmission<br>Type: string<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvSerialPortMaxResponseLength`<br>*GUI name: Serial Port Max Response Length* | Maximal expected length of the command response<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: B |

| Name | Description |
|---|---|
| `LvSerialPortCommandString`<br>*GUI name: Serial Port Command String* | String of the ASCII command to be sent over the serial port<br>Type: string<br>GUI visibility: expert |
| `LvSerialPortCommandSend`<br>*GUI name: Send Command Over Serial Port* | Sends the ASCII command over the serial port<br>Type: command<br>GUI visibility: expert |
| `LvSerialPortCommandResponse`<br>*GUI name: Serial Port Command Response* | Response to the ASCII command sent over the serial port<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `LvSerialPortCommandStatus`<br>*GUI name: Serial Port Command Status* | Status code indicating success of the last command<br>Type: enumeration<br>Possible values: `Success`, `Timeout`, `PortBusy`, `CommunicationError`, `FrameError`, `ParityError`, `Overflow`<br>GUI visibility: expert<br>Read-only feature |
| **Feature category: LUT Control and Image Adjustment** , refer to Section 6.10, “Luminance and color handling” [p. 156] | |
| `LvLUTMode`<br>*GUI name: LUT Mode* | Selects the LUT control mode<br>Type: enumeration<br>Possible values: `Direct`, `BalanceWhite`, `BrightnessContrast`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LUTSelector`<br>*GUI name: LUT Selector* | Selects which LUT to configure<br>Type: enumeration<br>Possible values: `Luminance`, `Red`, `Green`, `Blue`<br>GUI visibility: expert |
| `LUTEnable`<br>[`LUTSelector`]<br>*GUI name: LUT Enable* | Activates the selected LUT<br>Type: bool<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LUTIndex`<br>[`LUTSelector`]<br>*GUI name: LUT Index* | LUT element index<br>Type: integer<br>GUI visibility: guru |

| Name | Description |
|---|---|
| `LUTValue`<br>[`LUTIndex`]<br>*GUI name: LUT Value* | LUT value for the selected index<br>Type: integer<br>GUI visibility: guru<br>Streamable feature, stored with user configuration sets |
| `LUTValueAll`<br>[`LUTSelector`]<br>*GUI name: LUT Value All* | Accesses the entire content of the selected LUT in one chunk access<br>Type: raw register<br>GUI visibility: guru |
| `LvLUTReset`<br>[`LUTSelector`]<br>*GUI name: LUT Reset* | Resets the LUT settings<br>Type: command<br>GUI visibility: expert |
| `BalanceRatioSelector`<br>*GUI name: Balance Ratio Selector* | Selects which color channel to configure<br>Type: enumeration<br>Possible values: `Red`, `Green`, `Blue`<br>GUI visibility: expert |
| `BalanceRatio`<br>[`BalanceRatioSelector`]<br>*GUI name: Balance Ratio* | White balance ratio coefficient<br>Type: float<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `BalanceWhiteAuto`<br>*GUI name: Automatic White Balance* | Controls the mode for automatic white balancing between the color channels.<br>Type: enumeration<br>Possible values: `Off`, `Once`, `Continuous`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvLUTBrightness`<br>*GUI name: Brightness* | Brightness control<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: % |
| `LvLUTContrast`<br>*GUI name: Contrast* | Contrast control<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: % |
| **Feature category: Transport Layer Control** , refer to Section 6.4, “Transport layer control” [p. 102] | |

| Name | Description |
|---|---|
| `PayloadSize`<br>*GUI name: Payload Size* | Number of bytes provided for each image by the device<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: B |
| `GevVersionMajor`<br>*GUI name: GigE Vision Version Major* | Major version of the GEV specification<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `GevVersionMinor`<br>*GUI name: GigE Vision Version Minor* | Minor version of the GEV specification<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `GevDeviceModeIsBigEndian`<br>*GUI name: Device Mode Big Endian* | Endianess of the device registers<br>Type: bool<br>GUI visibility: guru<br>Read-only feature |
| `GevDeviceClass`<br>*GUI name: Device Class* | Returns the class of the device.<br>Type: enumeration<br>Possible values: `Transmitter`<br>GUI visibility: guru<br>Read-only feature |
| `GevDeviceModeCharacterSet`<br>*GUI name: Character Set* | Character set used by all the strings of the device registers<br>Type: enumeration<br>Possible values: `UTF8`<br>GUI visibility: guru<br>Read-only feature |
| `GevInterfaceSelector`<br>*GUI name: Interface Selector* | Selects which physical network interface to control<br>Type: integer<br>GUI visibility: beginner |
| `GevMACAddress`<br>[`GevInterfaceSelector`]<br>*GUI name: MAC Address* | MAC address of the network interface.<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |

| Name | Description |
|---|---|
| `GevSupportedOptionSelector`<br>*GUI name: Supported Option Selector* | Selects the GEV option to interrogate for existing support.<br>Type: enumeration<br>Possible values: `IPConfigurationPersistentIP`, `IPConfigurationDHCP`, `IPConfigurationLLA`, `CommandsConcatenation`, `WriteMem`, `PacketResend`, `Event`, `EventData`, `PendingAck`, `Action`, `PrimaryApplicationSwitchover`, `ExtendedStatusCodes`, `DiscoveryAckDelayWritable`, `DiscoveryAckDelay`, `TestData`, `ManifestTable`, `CCPApplicationSocket`, `LinkSpeed`, `HeartbeatDisable`, `SerialNumber`, `UserDefinedName`, `StreamChannelSourceSocket`, `StreamChannel0ExtendedChunkData`, `StreamChannel0UnconditionalStreaming`, `StreamChannel0IPReassembly`, `StreamChannel0BigAndLittleEndian`, `MessageChannelSourceSocket`<br>GUI visibility: expert |
| `GevSupportedOption`<br>[`GevSupportedOptionSelector`]<br>*GUI name: Supported Option* | Returns if the selected GEV option is supported.<br>Type: bool<br>GUI visibility: expert<br>Read-only feature |
| `GevCurrentIPConfigurationLLA`<br>[`GevInterfaceSelector`]<br>*GUI name: LLA Active* | Indicates if Link Local Address IP configuration scheme is activated on the given network interface.<br>Type: bool<br>GUI visibility: beginner<br>Read-only feature |
| `GevCurrentIPConfigurationDHCP`<br>[`GevInterfaceSelector`]<br>*GUI name: DHCP Active* | Indicates if DHCP IP configuration scheme is activated on the given network interface.<br>Type: bool<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |
| `GevCurrentIPConfigurationPersistentIP`<br>[`GevInterfaceSelector`]<br>*GUI name: Persistent IP Active* | Indicates if persistent IP configuration scheme is activated on the given network interface.<br>Type: bool<br>GUI visibility: beginner<br>Streamable feature, stored with user configuration sets |

| Name | Description |
|---|---|
| `GevCurrentIPAddress`<br>[`GevInterfaceSelector`]<br>*GUI name: Current IP Address* | Reports the IP address for the given network interface.<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevCurrentSubnetMask`<br>[`GevInterfaceSelector`]<br>*GUI name: Current Subnet Mask* | Provides the subnet mask of the given interface.<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevCurrentDefaultGateway`<br>[`GevInterfaceSelector`]<br>*GUI name: Current Default Gateway* | Indicates the default gateway IP address to be used on the given network interface.<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevIPConfigurationStatus`<br>[`GevInterfaceSelector`]<br>*GUI name: IP Configuration Status* | Reports the current IP configuration status.<br>Type: enumeration<br>Possible values: `None`, `PersistentIP`, `DHCP`, `LLA`, `ForceIP`<br>GUI visibility: beginner<br>Read-only feature |
| `GevPersistentIPAddress`<br>[`GevInterfaceSelector`]<br>*GUI name: Persistent IP Address* | Indicates the persistent IP address for this network interface.<br>Type: integer<br>GUI visibility: beginner |
| `GevPersistentSubnetMask`<br>[`GevInterfaceSelector`]<br>*GUI name: Persistent Subnet Mask* | Indicates the persistent subnet mask associated with the persistent IP address on this network interface.<br>Type: integer<br>GUI visibility: beginner |
| `GevPersistentDefaultGateway`<br>[`GevInterfaceSelector`]<br>*GUI name: Persistent Default Gateway* | Indicates the persistent default gateway for this network interface.<br>Type: integer<br>GUI visibility: beginner |
| `GevLinkSpeed`<br>[`GevInterfaceSelector`]<br>*GUI name: Link Speed* | Indicates the speed of transmission negotiated by the given network interface, in Mbs.<br>Type: integer<br>GUI visibility: expert<br>Unit: Mbps |
| `GevNumberOfInterfaces`<br>*GUI name: Number of Interfaces* | Indicates the number of physical network interfaces supported by this device.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |

| Name | Description |
|---|---|
| `GevMessageChannelCount`<br>*GUI name: Message Channel Count* | Indicates the number of message channels supported by this device.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `GevStreamChannelCount`<br>*GUI name: Stream Channel Count* | Indicates the number of stream channels supported by this device.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `GevHeartbeatTimeout`<br>*GUI name: Heartbeat Timeout* | Indicates the current heartbeat timeout in milliseconds.<br>Type: integer<br>GUI visibility: guru<br>Unit: ms |
| `GevTimestampTickFrequency`<br>*GUI name: Timestamp Tick Frequency* | Indicates the number of timestamp ticks during 1 second (frequency in Hz).<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: Hz |
| `GevTimestampControlLatch`<br>*GUI name: Timestamp Latch* | Latches current timestamp counter into GevTimestampValue.<br>Type: command<br>GUI visibility: expert |
| `GevTimestampControlReset`<br>*GUI name: Timestamp Reset* | Resets the Timestamp counter to 0.<br>Type: command<br>GUI visibility: expert |
| `GevTimestampControlLatchReset`<br>*GUI name: Timestamp Latch/Reset* | Reset and latch in a single command<br>Type: command<br>GUI visibility: expert |
| `GevTimestampValue`<br>*GUI name: Timestamp Value* | Returns the latched 64-bit value of the timestamp counter.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |

| Name | Description |
|---|---|
| `GevDiscoveryAckDelay`<br>*GUI name: Discovery Ack Delay* | Indicates the maximum randomized delay the device will wait to acknowledge a discovery command.<br>Type: integer<br>GUI visibility: expert<br>Unit: ms |
| `GevGVCPExtendedStatusCodes`<br>*GUI name: Extended Status Codes* | Enables the generation of extended status codes.<br>Type: bool<br>GUI visibility: guru |
| `GevGVCPPendingAck`<br>*GUI name: Pending Ack* | Enables the generation of PENDING_ACK.<br>Type: bool<br>GUI visibility: guru |
| `GevGVCPHeartbeatDisable`<br>*GUI name: Heartbeat Disable* | Disables the GVCP heartbeat.<br>Type: bool<br>GUI visibility: expert |
| `GevGVCPPendingTimeout`<br>*GUI name: Pending Timeout* | Indicates the longest GVCP command execution time before a device returns a PENDING_ACK.<br>Type: integer<br>GUI visibility: guru<br>Read-only feature<br>Unit: ms |
| `GevPrimaryApplicationSwitchoverKey`<br>*GUI name: Primary Application Switchover Key* | Controls the key to use to authenticate primary application switchover requests.<br>Type: integer<br>GUI visibility: guru |
| `GevCCP`<br>*GUI name: Control Channel Privilege* | Controls the device access privilege of an application.<br>Type: enumeration<br>Possible values: `OpenAccess`, `ExclusiveAccess`, `ControlAccess`, `ControlAccessSwitchoverActive`<br>GUI visibility: guru |
| `GevPrimaryApplicationSocket`<br>*GUI name: Primary Application Socket* | Returns the UDP source port of the primary application.<br>Type: integer<br>GUI visibility: guru<br>Read-only feature |
| `GevPrimaryApplicationIPAddress`<br>*GUI name: Primary Application IPAddress* | Returns the address of the primary application.<br>Type: integer<br>GUI visibility: guru<br>Read-only feature |

| Name | Description |
|---|---|
| `GevMCPHostPort`<br>*GUI name: Message Channel Host Port* | Controls the port to which the device must send messages.<br>Type: integer<br>GUI visibility: guru |
| `GevMCDA`<br>*GUI name: Message Channel Destination Address* | Controls the destination IP address for the message channel.<br>Type: integer<br>GUI visibility: guru |
| `GevMCTT`<br>*GUI name: Message Channel Transmission Timeout* | Provides the transmission timeout value in milliseconds.<br>Type: integer<br>GUI visibility: guru<br>Unit: ms |
| `GevMCRC`<br>*GUI name: Message Channel Retry Count* | Controls the number of retransmissions allowed when a message channel message times out.<br>Type: integer<br>GUI visibility: guru |
| `GevMCSP`<br>*GUI name: Message Channel Source Port* | This feature indicates the source port for the message channel.<br>Type: integer<br>GUI visibility: guru<br>Read-only feature |
| `GevStreamChannelSelector`<br>*GUI name: Stream Channel Selector* | Selects the stream channel to control.<br>Type: integer<br>GUI visibility: expert |
| `GevSCCFGUnconditionalStreaming`<br>[`GevStreamChannelSelector`]<br>*GUI name: Unconditional Streaming* | Enables the camera to continue to stream, for this stream channel, if its control channel is closed or regardless of the reception of any ICMP messages (such as destination unreachable messages).<br>Type: bool<br>GUI visibility: guru |
| `GevSCCFGExtendedChunkData`<br>[`GevStreamChannelSelector`]<br>*GUI name: Extended Chunk Data* | Enables cameras to use the extended chunk data payload type for this stream channel.<br>Type: bool<br>GUI visibility: guru |
| `GevSCPDirection`<br>[`GevStreamChannelSelector`]<br>*GUI name: Stream Direction* | Reports the direction of the stream channel.<br>Type: enumeration<br>Possible values: `Transmitter`<br>GUI visibility: guru<br>Read-only feature |

| Name | Description |
|---|---|
| GevSCPInterfaceIndex<br>[GevStreamChannelSelector]<br>*GUI name: Interface Index* | Index of network interface to use<br>Type: integer<br>GUI visibility: guru |
| GevSCPHostPort<br>[GevStreamChannelSelector]<br>*GUI name: Host Port* | Indicates the port to which the device must send data stream.<br>Type: integer<br>GUI visibility: guru |
| GevSCPSFireTestPacket<br>[GevStreamChannelSelector]<br>*GUI name: Fire Test Packet* | Sends a test packet.<br>Type: bool<br>GUI visibility: guru |
| GevSCPSDoNotFragment<br>[GevStreamChannelSelector]<br>*GUI name: Do Not Fragment* | The state of this feature is copied into the "do not fragment" bit of IP header of each stream packet.<br>Type: bool<br>GUI visibility: guru |
| GevSCPSBigEndian<br>[GevStreamChannelSelector]<br>*GUI name: Is Big Endian* | Specifies the stream packet size in bytes to send on this channel.<br>Type: bool<br>GUI visibility: guru<br>Read-only feature |
| GevSCPSPacketSize<br>[GevStreamChannelSelector]<br>*GUI name: Packet Size* | Specifies the stream packet size in bytes to send on this channel.<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: B |
| GevSCPD<br>[GevStreamChannelSelector]<br>*GUI name: Inter-Packet Delay* | Indicates the delay (in timestamp counter unit, which is currently a microsecond) to insert between each packet for this stream channel.<br>Type: integer<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets<br>Unit: us |
| GevSCDA<br>[GevStreamChannelSelector]<br>*GUI name: Stream Channel Destination* | Indicates the destination IP address for this stream channel.<br>Type: integer<br>GUI visibility: guru |
| GevSCSP<br>[GevStreamChannelSelector]<br>*GUI name: Stream Channel Source Port* | Indicates the source port of the stream channel.<br>Type: integer<br>GUI visibility: guru<br>Read-only feature |

| Name | Description |
|---|---|
| **Feature category: User Sets** , refer to Section 6.13, “User sets (saving/loading camera configuration)” [p. 179] | |
| `UserSetSelector`<br>*GUI name: User Configuration Set Selector* | Selects configuration set to configure<br>Type: enumeration<br>Possible values: `Default`, `UserSet1`, `UserSet2`, `UserSet3`, `UserSet4`<br>GUI visibility: beginner |
| `UserSetLoad`<br>[`UserSetSelector`]<br>*GUI name: User Set Load* | Loads the selected user set<br>Type: command<br>GUI visibility: beginner |
| `UserSetSave`<br>[`UserSetSelector`]<br>*GUI name: User Set Save* | Saves current configuration into the selected user set<br>Type: command<br>GUI visibility: beginner |
| `UserSetDefaultSelector`<br>*GUI name: Default Startup Set* | Selects the default feature configuraiton set<br>Type: enumeration<br>Possible values: `Default`, `UserSet1`, `UserSet2`, `UserSet3`, `UserSet4`, `None`<br>GUI visibility: beginner |
| **Feature category: Chunk Data Control** , refer to Section 6.11, “Chunk data” [p. 168] | |
| `ChunkModeActive`<br>*GUI name: Chunk Mode Active* | Enables the chunk mode<br>Type: bool<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `ChunkSelector`<br>*GUI name: Chunk Selector* | Selects the chunk to configure<br>Type: enumeration<br>Possible values: `OffsetX`, `OffsetY`, `Width`, `Height`, `PixelFormat`, `LinePitch`, `FrameID`, `Timestamp`, `ExposureTime`, `Gain`, `LineStatusAll`, `BlackLevel`, `LvExternalADCValue`, `LvSmartAppString`, `LvSmartAppInt`, `LvSmartAppUint`, `LvSmartAppRegister`, `LvTriggerDelayed`, `LvStrobeDropped`<br>GUI visibility: expert |
| `ChunkEnable`<br>[`ChunkSelector`]<br>*GUI name: Chunk Enable* | Enables the selected chunk<br>Type: bool<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |

| Name | Description |
|---|---|
| `ChunkOffsetX`<br>*GUI name: X Offset* | X offset applied to image included in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: px |
| `ChunkOffsetY`<br>*GUI name: Y Offset* | Y offset applied to image included in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: px |
| `ChunkWidth`<br>*GUI name: Width* | Width of the image included in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: px |
| `ChunkHeight`<br>*GUI name: Height* | Height of the image included in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: px |
| `ChunkPixelFormat`<br>*GUI name: Pixel Format* | Pixel format of the image included in the payload<br>Type: enumeration<br>Possible values: `Mono8`, `Mono8Signed`, `Mono10`, `Mono10Packed`, `Mono12`, `Mono12Packed`, `Mono16`, `BayerGR8`, `BayerRG8`, `BayerGB8`, `BayerBG8`, `BayerGR10`, `BayerRG10`, `BayerGB10`, `BayerBG10`, `BayerGR12`, `BayerRG12`, `BayerGB12`, `BayerBG12`, `RGB8Packed`, `BGR8Packed`, `RGBA8Packed`, `BGRA8Packed`<br>GUI visibility: expert<br>Read-only feature |
| `ChunkLinePitch`<br>*GUI name: Line Pitch* | Line pitch of the image included in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: B |
| `ChunkFrameID`<br>*GUI name: Frame ID* | Frame id of the image included in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |

| Name | Description |
|---|---|
| `ChunkTimestamp`<br>*GUI name: Timestamp* | Timestamp associated with the image included in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |
| `ChunkExposureTime`<br>*GUI name: Exposure Time* | Exposure time used to acquire the image included in the payload<br>Type: float<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |
| `ChunkGainSelector`<br>*GUI name: Gain Selector* | Gain type to be reported in chunk data<br>Type: enumeration<br>Possible values: `AnalogAll`, `DigitalAll`<br>GUI visibility: expert |
| `ChunkGain`<br>[`ChunkGainSelector`]<br>*GUI name: Gain* | Gain used to acquire the image included in the payload<br>Type: float<br>GUI visibility: expert<br>Read-only feature<br>Unit: dB |
| `ChunkBlackLevel`<br>*GUI name: Black Level* | Black level used to acquire the image included in the payload<br>Type: float<br>GUI visibility: expert<br>Read-only feature<br>Unit: DN |
| `ChunkLineStatusAll`<br>*GUI name: Line Status All* | Status of i/o lines at time of acquiring the image in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `ChunkLvExternalADCSelector`<br>*GUI name: External ADC Selector* | >External ADC to be reported in chunk data<br>Type: enumeration<br>Possible values: `ExternalADC1`, `ExternalADC2`, `ExternalADC3`, `ExternalADC4`<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `ChunkLvExternalADCValue`<br>[`ChunkLvExternalADCSelector`]<br>*GUI name: External ADC Value* | Value of the selected external ADC at time of acquisition of the image included in the payload<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: DN |
| `ChunkLvTriggerDelayed`<br>*GUI name: Trigger Delayed* | Flag indicating if the trigger was delayed when acquiring the image included in the payload<br>Type: bool<br>GUI visibility: expert<br>Read-only feature |
| `ChunkLvStrobeDropped`<br>*GUI name: Strobe Dropped* | Flag indicating if the configured strobe was dropped when acquiring the image included in the payload<br>Type: bool<br>GUI visibility: expert<br>Read-only feature |
| `ChunkLvSmartAppString`<br>*GUI name: Smart Application String* | The smart application string related to the delivered payload<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `ChunkLvSmartAppIntSelector`<br>*GUI name: Smart Application Signed Integer Selector* | Selects one of the signed integer values related to the delivered payload<br>Type: integer<br>GUI visibility: expert |
| `ChunkLvSmartAppInt`<br>[`ChunkLvSmartAppIntSelector`]<br>*GUI name: Smart Application Signed Integer* | The selected smart application signed integer related to the delivered payload<br>Type: integer<br>GUI visibility: expert |
| `ChunkLvSmartAppUintSelector`<br>*GUI name: Smart Application Unsigned Integer Selector* | Selects one of the unsigned integer values related to the delivered payload<br>Type: integer<br>GUI visibility: expert |
| `ChunkLvSmartAppUint`<br>[`ChunkLvSmartAppUintSelector`]<br>*GUI name: Smart Application Unsigned Integer* | The selected smart application unsigned integer related to the delivered payload<br>Type: integer<br>GUI visibility: expert |
| `ChunkLvSmartAppRegister`<br>*GUI name: Smart Application Register* | The smart application raw register related to the delivered payload<br>Type: raw register<br>GUI visibility: expert |
| **Feature category: Event Control** , refer to Section 6.12, “Asynchronous events” [p. 173] | |

| Name | Description |
|---|---|
| `EventSelector`<br>*GUI name: Event Selector* | Selects which event to signal to the host application.<br>Type: enumeration<br>Possible values: `LvLog`, `LvSmartAppLog`, `LvSmartAppString`, `LvSmartAppInt`, `LvSmartAppUint`, `LvSmartAppRegister`, `LvTriggerDropped`<br>GUI visibility: expert |
| `EventNotification`<br>[`EventSelector`]<br>*GUI name: Event Notification* | Activate or deactivate the notification to the host application of the selected event occurrence.<br>Type: enumeration<br>Possible values: `Off`, `On`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `EventLvLog`<br>*GUI name: Log Event* | Returns the unique identifier of the log type of event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `EventLvLogTimestamp`<br>*GUI name: Log Event Timestamp* | Returns the timestamp of the log event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |
| `EventLvLogMessage`<br>*GUI name: Log Event Message* | The log message coming with the event<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `EventLvTriggerDropped`<br>*GUI name: Trigger Dropped Event* | Returns the unique identifier of the dropped trigger type of event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `EventLvTriggerDroppedTimestamp`<br>*GUI name: Trigger Dropped Event Timestamp* | Returns the timestamp of the dropped trigger event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |

| Name | Description |
|---|---|
| `EventLvSmartAppLog`<br>*GUI name: Smart Application Log Event* | Returns the unique identifier of the smart application log type of event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `EventLvSmartAppLogTimestamp`<br>*GUI name: Smart Application Log Event Timestamp* | Returns the timestamp of the smart application Smart Application Log Event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |
| `EventLvSmartAppLogMessage`<br>*GUI name: Smart Application Log Event Message* | The smart application log message comming with the event<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `EventLvSmartAppString`<br>*GUI name: String Event* | Returns the unique identifier of the smart application string type of event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `EventLvSmartAppStringTimestamp`<br>*GUI name: String Event Timestamp* | Returns the timestamp of the smart application string event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |
| `EventLvSmartAppStringValue`<br>*GUI name: String Event Value* | The smart application string value coming with the event<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `EventLvSmartAppInt`<br>*GUI name: Signed Integer Event* | Returns the unique identifier of the smart application signed integer type of event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |

| Name | Description |
|---|---|
| `EventLvSmartAppIntTimestamp`<br>*GUI name: Signed Integer Event Timestamp* | Returns the timestamp of the smart application signed integer event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |
| `EventLvSmartAppIntSelector`<br>*GUI name: Signed Integer Event Selector* | Selects one of the signed integer values coming with the event<br>Type: integer<br>GUI visibility: expert |
| `EventLvSmartAppIntValue`<br>[`EventLvSmartAppIntSelector`]<br>*GUI name: Signed Integer Event Value* | Value of the selected signed integer coming with the event<br>Type: integer<br>GUI visibility: expert |
| `EventLvSmartAppUint`<br>*GUI name: Unsigned Integer Event* | Returns the unique identifier of the smart application unsigned integer type of event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `EventLvSmartAppUintTimestamp`<br>*GUI name: Unsigned Integer Event Timestamp* | Returns the timestamp of the smart application unsigned integer event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |
| `EventLvSmartAppUintSelector`<br>*GUI name: Unsigned Integer Event Selector* | Selects one of the unsigned integer values coming with the event<br>Type: integer<br>GUI visibility: expert |
| `EventLvSmartAppUintValue`<br>[`EventLvSmartAppUintSelector`]<br>*GUI name: Unsigned Integer Event Value* | Value of the selected unsigned integer coming with the event<br>Type: integer<br>GUI visibility: expert |
| `EventLvSmartAppRegister`<br>*GUI name: Register Event* | Returns the unique identifier of the smart application raw register type of event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |

| Name | Description |
|---|---|
| `EventLvSmartAppRegisterTimestamp`<br>*GUI name: Register Event Timestamp* | Returns the timestamp of the smart application raw register event.<br>Type: integer<br>GUI visibility: expert<br>Read-only feature<br>Unit: us |
| `EventLvSmartAppRegisterValue`<br>*GUI name: Register Event Value* | The smart application raw register value coming with the event<br>Type: raw register<br>GUI visibility: expert |
| **Feature category: Smart Application Features** , refer to Section 6.16, “Smart application control” [p. 200] | |
| `LvSmartAppID`<br>*GUI name: Smart Application ID* | ID string the smart application<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `LvSmartAppInt1`<br>*GUI name: Signed Integer 1* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt2`<br>*GUI name: Signed Integer 2* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt3`<br>*GUI name: Signed Integer 3* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt4`<br>*GUI name: Signed Integer 4* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt5`<br>*GUI name: Signed Integer 5* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt6`<br>*GUI name: Signed Integer 6* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvSmartAppInt7`<br>*GUI name: Signed Integer 7* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt8`<br>*GUI name: Signed Integer 8* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt9`<br>*GUI name: Signed Integer 9* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt10`<br>*GUI name: Signed Integer 10* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt11`<br>*GUI name: Signed Integer 11* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt12`<br>*GUI name: Signed Integer 12* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt13`<br>*GUI name: Signed Integer 13* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt14`<br>*GUI name: Signed Integer 14* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt15`<br>*GUI name: Signed Integer 15* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt16`<br>*GUI name: Signed Integer 16* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvSmartAppInt17`<br>*GUI name: Signed Integer 17* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt18`<br>*GUI name: Signed Integer 18* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt19`<br>*GUI name: Signed Integer 19* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt20`<br>*GUI name: Signed Integer 20* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt21`<br>*GUI name: Signed Integer 21* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt22`<br>*GUI name: Signed Integer 22* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt23`<br>*GUI name: Signed Integer 23* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt24`<br>*GUI name: Signed Integer 24* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt25`<br>*GUI name: Signed Integer 25* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt26`<br>*GUI name: Signed Integer 26* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvSmartAppInt27`<br>*GUI name: Signed Integer 27* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt28`<br>*GUI name: Signed Integer 28* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt29`<br>*GUI name: Signed Integer 29* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt30`<br>*GUI name: Signed Integer 30* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt31`<br>*GUI name: Signed Integer 31* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppInt32`<br>*GUI name: Signed Integer 32* | Generic signed integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint1`<br>*GUI name: Unsigned Integer 1* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint2`<br>*GUI name: Unsigned Integer 2* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint3`<br>*GUI name: Unsigned Integer 3* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint4`<br>*GUI name: Unsigned Integer 4* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvSmartAppUint5`<br>*GUI name: Unsigned Integer 5* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint6`<br>*GUI name: Unsigned Integer 6* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint7`<br>*GUI name: Unsigned Integer 7* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint8`<br>*GUI name: Unsigned Integer 8* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint9`<br>*GUI name: Unsigned Integer 9* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint10`<br>*GUI name: Unsigned Integer 10* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint11`<br>*GUI name: Unsigned Integer 11* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint12`<br>*GUI name: Unsigned Integer 12* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint13`<br>*GUI name: Unsigned Integer 13* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint14`<br>*GUI name: Unsigned Integer 14* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvSmartAppUint15`<br>*GUI name: Unsigned Integer 15* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint16`<br>*GUI name: Unsigned Integer 16* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint17`<br>*GUI name: Unsigned Integer 17* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint18`<br>*GUI name: Unsigned Integer 18* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint19`<br>*GUI name: Unsigned Integer 19* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint20`<br>*GUI name: Unsigned Integer 20* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint21`<br>*GUI name: Unsigned Integer 21* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint22`<br>*GUI name: Unsigned Integer 22* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint23`<br>*GUI name: Unsigned Integer 23* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint24`<br>*GUI name: Unsigned Integer 24* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvSmartAppUint25`<br>*GUI name: Unsigned Integer 25* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint26`<br>*GUI name: Unsigned Integer 26* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint27`<br>*GUI name: Unsigned Integer 27* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint28`<br>*GUI name: Unsigned Integer 28* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint29`<br>*GUI name: Unsigned Integer 29* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint30`<br>*GUI name: Unsigned Integer 30* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint31`<br>*GUI name: Unsigned Integer 31* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppUint32`<br>*GUI name: Unsigned Integer 32* | Generic unsigned integer register controlling a smart application.<br>Type: integer<br>GUI visibility: expert |
| `LvSmartAppAsciiCmdString`<br>*GUI name: ASCII Command String* | String of the ASCII command for the smart application<br>Type: string<br>GUI visibility: expert |
| `LvSmartAppAsciiCmdExecute`<br>*GUI name: ASCII Command Execute* | Executes the ASCII command for the smart application<br>Type: command<br>GUI visibility: expert |

| Name | Description |
|---|---|
| `LvSmartAppAsciiCmdFeedback`<br>*GUI name: ASCII Command Response* | Response to the ASCII command for the smart application<br>Type: string<br>GUI visibility: expert<br>Read-only feature |
| `LvSmartAppAsciiCmdRetCode`<br>*GUI name: ASCII Command Return Code* | Numeric return code of the ASCII command for the smart application<br>Type: integer<br>GUI visibility: expert<br>Read-only feature |
| `LvSmartAppPath`<br>*GUI name: Smart Application Path* | Path of the smart application to be started<br>Type: string<br>GUI visibility: expert |
| `LvSmartAppStart`<br>*GUI name: Start Smart Application* | Starts the smart application defined by the path<br>Type: command<br>GUI visibility: expert |
| `LvSmartAppExitEvent`<br>*GUI name: Send Smart Application Exit Event* | Sends an exit event to the running smart application<br>Type: command<br>GUI visibility: expert |

*Table 6.2. Summary of all camera features (some of them available only by specific models)*

# 7. Simplon GenTL Producer features

The behaviour of the Simplon GenTL Producer can be controlled through feature trees, similarly as the features of the camera itself (the camera features were documented in Chapter 6, *Camera features and their control* [p. 96]). The basic principles of work with the Simplon GenTL Producer features are same as with the camera features, refer to the introduction in Section 6.1, "Common principles" [p. 96].

This chapter will discuss the Simplon GenTL Producer features, some of them dictated by the GenTL standard, others specific to Simplon. The chapter will discuss the Simplon GenTL Producer in general, considering all Leutron Vision camera families. Note that the chapter is irrelevant for users connecting to our GigE Vision cameras (PicSight-GigE/PicSight-Smart) directly through the GigE Vision interface of a 3rd party library — in such case the Simplon GenTL Producer is not involved.

A feature set is associated with every GenTL module instance. The module types are:

- System — represents the entire GenTL producer.
- Interface — an interface through which the cameras (devices) are connected to the system.
- Device — GenTL producer's view of the camera (device).
- Data stream — controls image acquisition from the camera.
- Buffer — wraps a single acquisition buffer. Simplon GenTL Producer currently does not provide any buffer related features.

The availability and use of the individual features is the same, regardless if you access the Simplon GenTL Producer through Simplon API or through a 3rd party GenTL compatible library. Individual libraries might slightly differ in details such as how the individual GenTL modules are enumerated and opened, but the functionality will be the same in the end. For more information about the GenTL producer access and configuration, refer to Simplon programmer's guide or to documentation of the 3rd party library you are using. You might also want to study Chapter 8, *Connecting with 3rd party software packages* [p. 269].

Overview of all the supported features is in Section 7.5, "Simplon GenTL Producer feature summary" [p. 262].

The Simplon API extends the individual feature sets with even more features for each "GenTL module". These features are, however, discussed in the corresponding manual, Simplon programmer's guide.

## 7.1. GenTL system module

The system module represents the entire GenTL producer, there's always exactly one instance of this module. It allows to obtain basic information about the GenTL producer, enumerate its available device interfaces and obtain basic information about the interfaces even before actually opening them.

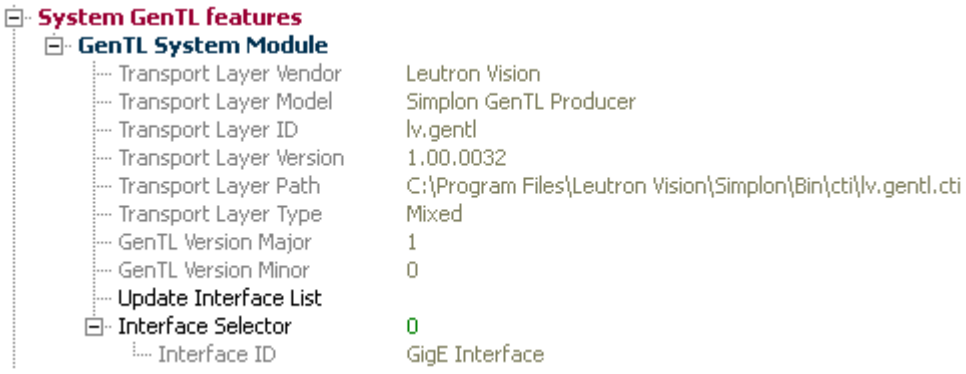



*Figure 7.1. Example GUI showing the GenTL system module features*

## 7.1.1. Information about the system

The system module provides basic set of features describing the GenTL producer implementation:

*Transport Layer Vendor* — Name of the vendor implementing given GenTL producer. For Simplon GenTL Producer this naturally reads `Leutron Vision`.

*Transport Layer Model* — Name of the GenTL producer itself, in our case `Simplon GenTL Producer`.

*Transport Layer ID* — Unique ID of the transport layer producer. This feature is used for communication between the GenTL producer and consumer, it should not be interpreted anyhow by the user.

*Transport Layer Version* — String representation of the GenTL producer's version number. This feature provides the version number of the installed Simplon package.

*Transport Layer Path* — Path to the GenTL producer file (the `.cti` file). The exact location depends on how the Simplon package was installed.

*Transport Layer Type* — Another feature dictated by the GenTL specification. It informs the consumer about the camera interface technologies it supports. For Simplon GenTL Producer it's always *Mixed*, because the producer supports multiple camera interfaces (CheckSight/CheckSight-II cameras and GigE Vision compatible cameras).

*GenTL Version Major/GenTL Version Minor* — Major/minor version of the GenTL specification implemented by the producer.

*GigE Vision Version Major/GigE Vision Version Minor* — Major/minor version of the GigE Vision specification implemented by the GenTL producer's component handling GigE Vision cameras.

Simplon

```
LvHSystem hSys; // open the system to get the handle
// read basic information about the system
char StringVal[1024];
LvGetString (hSys, LvSystem_TLVendorName, StringVal, 1024);
LvGetString (hSys, LvSystem_TLModelName, StringVal, 1024);
```

```
LvGetString (hSys, LvSystem_TLID, StringVal, 1024);
LvGetString (hSys, LvSystem_TLVersion, StringVal, 1024);
LvGetString (hSys, LvSystem_TLPath, StringVal, 1024);
int32_t EnumVal;
LvGetEnum(hSys, LvSystem_TLType, &EnumVal);
int32_t IntVal;
LvGetInt32 (hSys, LvSystem_GenTLVersionMajor, &IntVal);
LvGetInt32 (hSys, LvSystem_GenTLVersionMinor, &IntVal);
LvGetInt32 (hSys, LvSystem_GevVersionMajor, &IntVal);
LvGetInt32 (hSys, LvSystem_GevVersionMinor, &IntVal);
```

GEN<i>CAM

```
// read basic information about the system
read_string (TLVendorName)
read_string (TLModelName)
read_string (TLID)
read_string (TLVersion)
read_string (TLPath)
read_enum (TLType)
read_int (GenTLVersionMajor)
read_int (GenTLVersionMinor)
read_int (GevVersionMajor)
read_int (GevVersionMinor)
```

## 7.1.2. Interface enumeration

The system module also provides means for GenTL interface enumeration and querying basic information about the interfaces without need to open them. Note that some of the GigE Vision specific features are only available on the GigE Vision interfaces — and even only if the producer creates one interface module for every network card (see also Section 7.2, “GenTL interface module” [p. 252]).

*Update Interface List*

Command asking the GenTL producer to rescan the currently available camera interfaces and update its internal interface list.

Note that Simplon API executes this command internally when enumerating/discovering the interfaces, so there's no need to access this feature directly when using Simplon API.

*Interface Selector*

Selects one of the discovered interfaces and allows to query information about the interfaces through the depending features (see below).

The *Interface Selector* is an integer feature with zero-based indexing of the discovered interfaces. The index corresponds with the same index in the GenTL C interface. The current range of the selector (zero through its current maximum) corresponds with the number of discovered interfaces.

Note that in Simplon API the interfaces are accessed through corresponding handles and the interface indexes/ID's are fully wrapped into the handles — they can be usually ignored by Simplon API users.

| | |
|---|---|
| *Interface ID* | Unique ID of the selected interface. This feature is used for communication between the GenTL producer and consumer, it should not be interpreted anyhow by the user. |
| *Interface MAC Address* | MAC address corresponding with the selected interface.<br><br>GigE Vision interfaces only. |
| *Interface Default IP Address* | Default IP address configured on the selected interface.<br><br>GigE Vision interfaces only. |
| *Interface Default Subnet Mask* | Default subnet mask configured on the selected interface.<br><br>GigE Vision interfaces only. |
| *Interface Default Gateway* | Default gateway configured on the selected interface.<br><br>GigE Vision interfaces only. |

Simplon

```
LvHSystem hSys; // open the system to get the handle
// rescan the list of available interfaces
// (waiting for operation completion)
LvCmdExecute (hSys, LvSystem_InterfaceUpdateList);
// (now wait until the operation end using LvCmdIsDone())
// read information about the first discovered interface
// (i.e. interface with index 0)
LvSetInt32 (hSys, LvSystem_InterfaceSelector, 0);
char StringVal[1024];
LvGetString (hSys, LvSystem_InterfaceID, StringVal, 1024);
if (LvIsAvailable (hSys, LvSystem_GevInterfaceMACAddress))
{
    // MAC/IP addresses can be read as integers or formatted strings
    int32_t IntVal;
    int64_t Int64Val;
    LvGetInt64 (hSys, LvSystem_GevInterfaceMACAddress, &Int64Val);
    LvGetString (hSys, LvSystem_GevInterfaceMACAddress, StringVal, 1024);
    LvGetInt32 (hSys, LvSystem_GevInterfaceDefaultIPAddress, &IntVal);
    LvGetInt32 (hSys, LvSystem_GevInterfaceDefaultSubnetMask, &IntVal);
    LvGetInt32 (hSys, LvSystem_GevInterfaceDefaultGateway, &IntVal);
}
```

GEN<i>CAM

```
// rescan the list of available interfaces
// (waiting for operation completion)
exec_cmd (InterfaceUpdateList)
wait_until_done (InterfaceUpdateList)
// read information about the first discovered interface
// (i.e. interface with index 0)
write_int (InterfaceSelector, 0)
read_string (InterfaceID)
read_int (GevInterfaceMACAddress)
read_int (GevInterfaceDefaultIPAddress)
```

```
read_int (GevInterfaceDefaultSubnetMask)
read_int (GevInterfaceDefaultGateway)
```

# 7.2. GenTL interface module

The interface module symbolizes a physical interface through which the GenTL producer discovers and connects to the cameras (“devices”). It allows to obtain basic information about the interface, enumerate the devices currently accessible through the interface and obtain basic information about the devices even before actually opening them.

- The CheckSight/CheckSight-II cameras are always connected through a “PCI Interface”. The name indicates that the camera's acquisition module is connected to the system through PCI-Express.
- The GigE Vision cameras (PicSight-GigE, PicSight-Smart or any other GigE Vision compatible cameras) connect through dedicated interface(s). Depending on Simplon version and/or configuration there might be either a single common logical interface called “GigE Interface” which encapsulates all physical network interfaces (network cards) available in the system. Alternately, there might be one GenTL interface per physical network card. In the latter case, the network related information features (such as MAC address) are reported. When using the single logical interface, representing all the network cards, the per-card features are hidden.

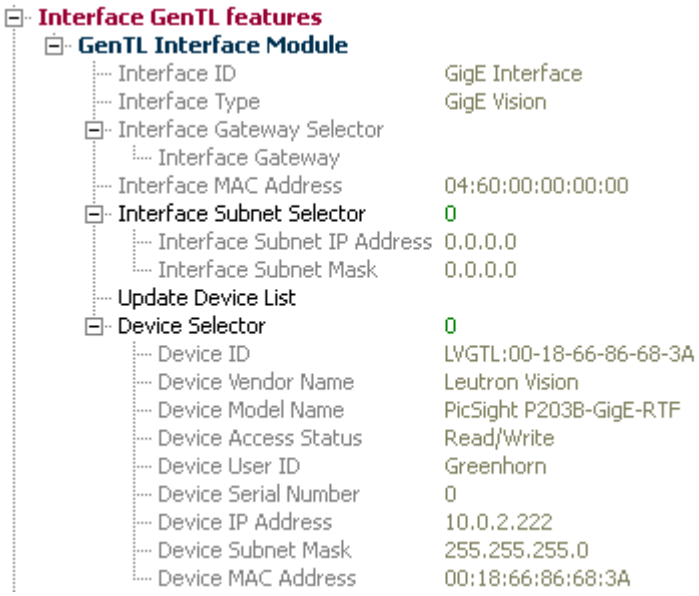



*Figure 7.2. Example GUI showing the GenTL interface module features*

## 7.2.1. Information about the interface

The interface module provides basic set of features describing its properties:

*Interface ID* — Unique ID of the interface. This feature is used for communication between the GenTL producer and consumer, it should not be interpreted anyhow by the user.

*Interface Type* — A feature dictated by the GenTL specification. It informs the consumer about the camera interface technology it supports. For Simplon GenTL Producer it's always *GigE Vision* for the interface(s) handling the GigE Vision cameras (such as PicSight-GigE) and *Custom* for the interface controlling CheckSight/CheckSight-II.

| | |
|---|---|
| *Interface MAC Address* | MAC address corresponding with the interface.<br><br>GigE Vision interfaces only. |
| Interface gateways' information | The *Interface Gateway Selector* feature (zero based integer index) allows to loop through the gateways configured for given GigE Vision interface. The *Interface Gateway* then reports the IP address of the selected gateway.<br><br>GigE Vision interfaces only. |
| Interface subnets' information | The *Interface Subnet Selector* feature (zero based integer index) allows to loop through the subnets configured for given GigE Vision interface. The *Interface Subnet IP Address*/*Interface Subnet Mask* then report the IP address and subnet mask corresponding with the selected subnet.<br><br>GigE Vision interfaces only. |

Simplon

```
LvHInterface hItf; // open the interface to get the handle
// read basic information about the interface
char StringVal[1024];
LvGetString (hItf, LvInterface_InterfaceID, StringVal, 1024);
int32_t EnumVal;
LvGetEnum(hItf, LvInterface_InterfaceType, &EnumVal);
if (LvIsAvailable (hItf, LvInterface_GevMACAddress))
{
    // MAC/IP addresses can be read as integers or formatted strings
    int32_t IntVal;
    int64_t Int64Val;
    LvGetInt64 (hItf, LvInterface_GevMACAddress, &Int64Val);
    LvGetString (hItf, LvInterface_GevMACAddress, StringVal, 1024);
    // first gateway
    LvSetInt32 (hItf, LvInterface_GevInterfaceGatewaySelector, 0);
    LvGetInt32 (hItf, LvInterface_GevInterfaceGateway, &IntVal);
    // first subnet
    LvSetInt32 (hItf, LvInterface_GevInterfaceSubnetSelector, 0);
    LvGetInt32 (hItf, LvInterface_GevInterfaceSubnetIPAddress, &IntVal);
    LvGetInt32 (hItf, LvInterface_GevInterfaceSubnetMask, &IntVal);
}
```

GEN<i>CAM

```
// read basic information about the interface
read_string (InterfaceID)
read_enum (InterfaceType)
read_int (GevMACAddress)
// first gateway
write_int (GevInterfaceGatewaySelector, 0)
read_int (GevInterfaceGateway)
// first subnet
write_int (GevInterfaceSubnetSelector, 0)
read_int (GevInterfaceSubnetIPAddress)
read_int (GevInterfaceSubnetMask)
```

## 7.2.2. Device enumeration

The interface module also provides means for device (camera) enumeration and querying basic information about the devices without need to open them. Note that some of the GigE Vision specific features are only available for the GigE Vision devices Unlike with interface enumeration, the device enumeration might be done repeatedly at runtime by some applications since devices (in particular the GigE Vision cameras) might go away or get connected to the system any time, so the device list is more dynamic by its nature.

*Update Device List*
: Command asking the GenTL producer to rescan the list of devices currently accessible through given interface.

  Keep in mind that after the update, the contents of the list of the devices "known" to the Simplon GenTL Producer might change, including their order. Handles to the opened devices are guaranteed to remain valid, however.

  Note that Simplon API executes this command internally when enumerating/discovering the devices, so there's no need to access this feature directly when using Simplon API.

*Device Selector*
: Selects one of the discovered devices and allows to query information about the devices through the depending features (see below).

  The *Device Selector* is an integer feature with zero-based indexing of the discovered devices. The index corresponds with the same index in the GenTL C interface. The current range of the selector (zero through its current maximum) corresponds with the number of discovered devices.

  Note that in Simplon API the devices are accessed through corresponding handles and the device indexes/ID's are fully wrapped into the handles — they can be usually ignored by Simplon API users.

*Device ID*
: Globally unique ID of the selected device. This feature is used for communication between the GenTL producer and consumer, it should not be interpreted anyhow by the user.

*Device Vendor Name*
: Name of the selected camera's vendor (manufacturer).

*Device Model Name*
: Model name of the selected camera.

*Device Access Status*
: Access status of the selected device at the time of the last device list update. This enumeration feature can report following status options: *Read/Write* (the device can be opened for reading and writing), *Read Only* (the device can be opened in read-only mode), *No Access* (the device cannot be currently opened — e.g. because it's opened by another application already).

*Device User ID*
: User ID (also known as nickname) of the selected device. The user ID's can be assigned by the user to individual cameras — and used as custom device identification scheme. In Simplon API the User ID can be directly used as device (camera) identifier when opening it.

*Device Serial Number*
: Serial number (as a string) of the selected device.

*Device MAC Address*
: MAC address of the selected device.

  GigE Vision devices only.

| | |
|---|---|
| *Device IP Address* | Current IP address of the selected device.<br>GigE Vision devices only. |
| *Device Subnet Mask* | Current subnet mask of the selected device.<br>GigE Vision devices only. |

Simplon

```
LvHInterface hItf; // open the interface to get the handle
// rescan the list of available devices
// (waiting for operation completion)
LvCmdExecute (hItf, LvInterface_DeviceUpdateList);
// (now wait until the operation end using LvCmdIsDone())
// read information about the first discovered device
// (i.e. device with index 0)
LvSetInt32 (hItf, LvInterface_DeviceSelector, 0);
char StringVal[1024];
LvGetString (hItf, LvInterface_DeviceID, StringVal, 1024);
LvGetString (hItf, LvInterface_DeviceVendorName, StringVal, 1024);
LvGetString (hItf, LvInterface_DeviceModelName, StringVal, 1024);
LvGetString (hItf, LvInterface_LvDeviceUserID, StringVal, 1024);
LvGetString (hItf, LvInterface_LvDeviceSerialNumber, StringVal, 1024);
int32_t EnumVal;
LvGetEnum(hItf, LvInterface_DeviceAccessStatus, &EnumVal);
// MAC/IP addresses can be read as integers or formatted strings
int32_t IntVal;
int64_t Int64Val;
LvGetInt64 (hItf, LvInterface_GevDeviceMACAddress, &Int64Val);
LvGetString (hItf, LvInterface_GevDeviceMACAddress, StringVal, 1024);
LvGetInt32 (hItf, LvInterface_GevDeviceIPAddress, &IntVal);
LvGetInt32 (hItf, LvInterface_GevDeviceSubnetMask, &IntVal);
```

GEN<i>CAM

```
// rescan the list of available devices
// (waiting for operation completion)
exec_cmd (DeviceUpdateList)
wait_until_done (DeviceUpdateList)
// read information about the first discovered device
// (i.e. device with index 0)
write_int (DeviceSelector, 0)
read_string (DeviceID)
read_string (DeviceVendorName)
read_string (DeviceModelName)
read_string (LvDeviceUserID)
read_string (LvDeviceSerialNumber)
read_enum (DeviceAccessStatus)
read_int (GevDeviceMACAddress)
read_int (GevDeviceIPAddress)
read_int (GevDeviceSubnetMask)
```

# 7.3. GenTL device module

The device module provides a GenTL producer's local view of each opened camera (“device”) — there's one instance for every device you open. Note that this does not refer to the features exported by the camera itself (those were discussed in Chapter 6, *Camera features and their control* [p. 96]), but rather to the features exported by the GenTL producer itself, controlling how it handles the camera.

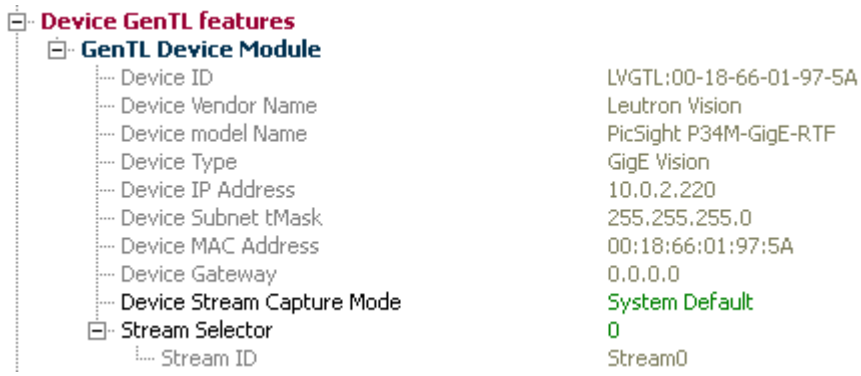



*Figure 7.3. Example GUI showing the GenTL device module features*

## 7.3.1. Information about the device

The device module provides basic set of features describing its properties:

*Device ID* — Globally unique ID of the device. This feature is used for communication between the GenTL producer and consumer, it should not be interpreted anyhow by the user.

*Device Type* — A feature dictated by the GenTL specification. It informs the consumer about the camera's interface technology it is based on. For Simplon GenTL Producer it's always *GigE Vision* for the GigE Vision cameras (such as PicSight-GigE) and *Custom* for the CheckSight/CheckSight-II cameras.

*Device Vendor Name* — Name of the camera's vendor (manufacturer).

*Device Model Name* — Model name of the camera.

*Device MAC Address* — MAC address of the device.

GigE Vision devices only.

*Device IP Address* — Current IP address of the device.

GigE Vision devices only.

*Device Subnet Mask* — Current subnet mask of the device.

GigE Vision devices only.

*Device Gateway* — Current default gateway of the device.

GigE Vision devices only.

```
LvHDevice hDev; // open the device to get the handle
// read basic information about the device
char StringVal[1024];
LvGetString (hDev, LvDevice_DeviceID, StringVal, 1024);
int32_t EnumVal;
LvGetEnum(hDev, LvDevice_DeviceType, &EnumVal);
LvGetString (hDev, LvDevice_DeviceVendorName, StringVal, 1024);
LvGetString (hDev, LvDevice_DeviceModelName, StringVal, 1024);
// MAC/IP addresses can be read as integers or formatted strings
int32_t IntVal;
int64_t Int64Val;
LvGetInt64 (hDev, LvDevice_GevDeviceMACAddress, &Int64Val);
LvGetString (hDev, LvDevice_GevDeviceMACAddress, StringVal, 1024);
LvGetInt32 (hDev, LvDevice_GevDeviceIPAddress, &IntVal);
LvGetInt32 (hDev, LvDevice_GevDeviceSubnetMask, &IntVal);
LvGetInt32 (hDev, LvDevice_GevDeviceGateway, &IntVal);
```

GEN<i>CAM

```
// read basic information about the device
read_string (DeviceID)
read_enum (DeviceType)
read_string (DeviceVendorName)
read_string (DeviceModelName)
read_int (GevDeviceMACAddress)
read_int (GevDeviceIPAddress)
read_int (GevDeviceSubnetMask)
read_int (GevDeviceGateway)
```

## 7.3.2. Stream enumeration

The interface module also provides means for stream “enumeration”, according to the GenTL specification. However, Simplon GenTL Producer currently always uses just a single stream per device. For streams, there's no “update stream list” command like with other module types, the stream (s) configuration is always known upon opening the device module and remains fixed.

*Stream Selector* — Selects one of the streams belonging to the device and allows to query information about the stream through the depending features (see below).

The *Stream Selector* is an integer feature with zero-based indexing of the device streams. The index corresponds with the same index in the GenTL C interface. The current range of the selector (zero through its current maximum) corresponds with the number of streams of the device.

Note that in Simplon API the streams are accessed through corresponding handles and the stream indexes/ID's are fully wrapped into the handles — they can be usually ignored by Simplon API users.

*Stream ID* — Unique ID of the selected stream. This feature is used for communication between the GenTL producer and consumer, it should not be interpreted anyhow by the user.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// read information about the first stream of the device
// (i.e. stream with index 0)
```

```
LvSetInt32 (hDev, LvDevice_StreamSelector, 0);
char StringVal[1024];
LvGetString (hDev, LvDevice_StreamID, StringVal, 1024);
```

GEN<i>CAM

```
// read information about the first stream of the device
// (i.e. stream with index 0)
write_int (StreamSelector, 0)
read_string (StreamID)
```

## 7.3.3. GigE Vision streaming control

This topic is specific to GigE Vision devices only. When acquiring images from a GigE Vision camera, depending on the camera's data rate and configuration, the amount of data being sent over the network in the image stream can be high enough to generate significant processor load and consume other system resources — especially when being processed through the regular operating system's network stack. The Simplon GenTL Producer provides a network filter driver to minimize such processing overhead, see Section 5.2.5, “Network filter driver” [p. 80].

The feature *Device Stream Capture Mode* allows to select, which stream capture mode should be used for given device. Possible options are:

- *System Default* (the default option) — the capture mode will be selected according to the default option adjusted in the Simplon configuration file (Section 5.7, “Simplon configuration” [p. 93]). Name of the corresponding configuration (boolean) option is `Default use of filter driver`.
- *Socket* — the image data from this camera will be captured through the regular socket interface, regardless of the global default configuration.
- *Filter Driver* — the image data from this camera will be captured through the filter driver interface, regardless of the global default configuration.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// use system default GigE Vision stream capture mode
// (configurable through Simplon ini-file)
LvSetEnum (hDev, LvDevice_LvGevDeviceStreamCaptureMode,
                 LvGevDeviceStreamCaptureMode_SystemDefault);
// capture the GigE Vision image stream through standard socket
LvSetEnum (hDev, LvDevice_LvGevDeviceStreamCaptureMode,
                 LvGevDeviceStreamCaptureMode_Socket);
// capture the GigE Vision image stream through the filter driver
LvSetEnum (hDev, LvDevice_LvGevDeviceStreamCaptureMode,
                 LvGevDeviceStreamCaptureMode_FilterDriver);
```

GEN<i>CAM

```
// use system default GigE Vision stream capture mode
// (configurable through Simplon ini-file)
write_enum (LvGevDeviceStreamCaptureMode, SystemDefault)
// capture the GigE Vision image stream through standard socket
write_enum (LvGevDeviceStreamCaptureMode, Socket)
// capture the GigE Vision image stream through the filter driver
write_enum (LvGevDeviceStreamCaptureMode, FilterDriver)
```

## 7.3.4. GigE Vision communication control

This topic is specific to GigE Vision devices only. When controlling a GigE Vision camera, the Simplon GenTL Producer (and every GigE Vision compliant software) uses the GVCP protocol, which basically consists of commands issued by the host software and acknowledges responded by the device. If the acknowledge from the device does not arrive within the expected timeout, Simplon GenTL Producer assumes that delivery of the command failed and eventually retries sending it again. Both the timeout and number of eventual retries can be configured by the user through features *Control Channel Transmission Timeout* (value in ms) and *Control Channel Retry Count*.

If the device itself provides hints about the maximal expectable response timeout, Simplon GenTL Producer uses this hint to adjust the initial value of *Control Channel Transmission Timeout*, otherwise it defaults to 200 ms.

The default values used by Simplon GenTL Producer will work just fine in vast majority of cases and the user should attempt to readjust them only if encountering a communication problem (such as failing read/write operations) with a particular camera, usually with guidance of our support staff. The features become visible only at the “guru” feature visibility level. Note that it is important to configure these values before the problematic communication with the device can ever happen, ie. typically before accessing the feature tree of the remote device.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// adjust control channel retransmission parameters
LvSetInt32 (hDev, LvDevice_LvGevCCRC, 3);
LvSetInt32 (hDev, LvDevice_LvGevCCTT, 500); // ms
```

GEN<i>CAM

```
// adjust message channel retransmission parameters
write_int (LvGevCCRC, 3)
write_int (LvGevCCTT, 500) // ms
```

## 7.3.5. Determining the GigE Vision streaming packet size

This topic is specific to GigE Vision devices only. When acquiring the image data from a GigE Vision camera, it is usually desirable to stream the data using larger packets to improve the performance, see Section 5.2, “Network performance” [p. 72]. The possible packet size value is, however, limited by the capabilities of the networking hardware involved. When connecting to a camera, the Simplon GenTL Producer determines the maximal packet size usable with the current network configuration and adjusts it on the camera. For applications needing to further control the packet size while working with the camera, Simplon GenTL Producer provides two additional features (available only in the “guru” feature visibility level). Remember, that changing the streaming packet size on the fly might be tricky and these features must never be used while any streaming is active.

When the application suspects that the conditions affecting the maximal possible packet size are incorrect or if the packet size became otherwise invalid, the procedure to determine the maximal possible packet size can be executed again using the *Find Maximal Packet Size* command. When the operation finishes, the resulting maximal packet size usable with the device and current network configuration can be retrieved from *Packet Size Value*. The application can then actually apply the packet size on the camera itself (using the Packet Size™ feature in the remote device feature tree) whenever suitable — but not during active streaming.

For applications requiring even finer approach to packet size control, the Simplon GenTL Producer can be asked to verify if a given packet size is valid on the current network configuration. The specified packet size would be verified, but not applied — this is left for the application. The

packet size to be tested should be specified in *Packet Size Value* and the verification procedure started using the *Test Packet Size* command. The success (usability of given packet size) is reported in *Packet Size Test Success*.

Simplon

```
LvHDevice hDev; // open the device to get the handle
// determine the maximal usable packet size...
LvCmdExecute (hDev, LvDevice_LvGevFindMaxPacketSize);
// ...now wait until the operation end using LvCmdIsDone()
// and read the result (will not be automatically applied,
// the application has to configure the camera explicitly)
int32_t IntVal;
LvGetInt32 (hDev, LvDevice_LvGevPacketSizeValue, &IntVal);
// test if packet size 9000 is usable with current configuration...
LvSetInt32 (hDev, LvDevice_LvGevPacketSizeValue, 9000);
LvCmdExecute (hDev, LvDevice_LvGevTestPacketSize);
// ...now wait until the operation end using LvCmdIsDone()
// and read the result
LvGetBool (hDev, LvDevice_LvGevPacketSizeTestSuccess, &IntVal);
```

GEN<i>CAM

```
// determine the maximal usable packet size...
exec_cmd (LvGevFindMaxPacketSize)
// ...now wait until the operation end using command's IsDone property
// (will not be automatically applied,
// the application has to configure the camera explicitly)
read_int (LvGevPacketSizeValue)
// test if packet size 9000 is usable with current configuration...
write_int (LvGevPacketSizeValue, 9000)
exec_cmd (LvGevTestPacketSize)
// ...now wait until the operation end using command's IsDone property
// and read the result
read_bool (LvGevPacketSizeTestSuccess)
```

# 7.4. GenTL data stream module

The stream module controls the image acquisition from the device. In the moment, the Simplon GenTL Producer is always using just a single data stream per device.

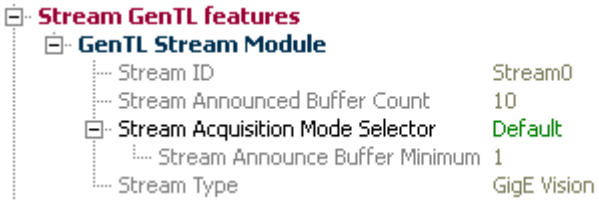



*Figure 7.4. Example GUI showing the GenTL data stream module features*

## 7.4.1. Information about the stream

The data stream module provides basic set of features describing its properties:

*Stream ID*

Unique ID of the stream. This feature is used for communication between the GenTL producer and consumer, it should not be interpreted anyhow by the user.

*Stream Type*

A feature dictated by the GenTL specification. It informs the consumer about the camera interface technology of the camera device the stream belongs to. For Simplon GenTL Producer it's always *GigE Vision* for streams belonging to the GigE Vision cameras (such as PicSight-GigE) and *Custom* for stream belonging to CheckSight/CheckSight-II.

*Stream Announced Buffer Count*

Number of buffers currently announced by the GenTL consumer to the stream. This value is “volatile”, it can be changed at any time by the consumer when adding/removing acquisition buffers from the stream.

*Stream Acquisition Mode Selector*

Selects the acquisition mode to be used by the stream. Acquisition mode describes how the data stream handles the pool of input acquisition buffers, which buffers it delivers first to the consumer (application) and how buffer locking behaves.

Simplon GenTL Producer currently supports just a single acquisition mode — the default acquisition mode required by the GenTL specification. In this mode the buffers are delivered to the consumer (application) in FIFO order, the application must explicitly queue (unlock) all the buffers after processing to make them again available to the acquisition engine and the acquisition engine never overwrites any buffers in the output queue — when overflown, new images are dropped.

*Stream Announce Buffer Minimum*

Minimum number of acquisition buffers the stream requires for operation. The value depends on the acquisition mode. For the current version of Simplon GenTL Producer and the default acquisition mode the minimum is `1`.

Simplon

```
LvHStream hStrm; // open the stream to get the handle
// read basic information about the stream
char StringVal[1024];
LvGetString (hStrm, LvStream_StreamID, StringVal, 1024);
int32_t EnumVal;
LvGetEnum(hStrm, LvStream_StreamType, &EnumVal);
int32_t IntVal;
LvGetInt32 (hStrm, LvStream_StreamAnnouncedBufferCount, &IntVal);
LvGetEnum(hStrm, LvStream_StreamAcquisitionModeSelector, &EnumVal);
LvGetInt32 (hStrm, LvStream_StreamAnnounceBufferMinimum, &IntVal);
```

GEN<i>CAM

```
// read basic information about the stream
read_string (StreamID)
read_enum (StreamType)
read_int (StreamAnnouncedBufferCount)
read_enum (StreamAcquisitionModeSelector)
read_int (StreamAnnounceBufferMinimum)
```

# 7.5. Simplon GenTL Producer feature summary

The following table provides condensed summary of all the features provided by the Simplon GenTL Producer for individual GenTL modules. Some of the features are only relevant for certain camera families. The range of allowed values might differ depending on the actual system configuration.

For detailed explanation of the purpose of each feature group and their dependencies, refer to previous sections in this chapter.

| Name | Description |
|---|---|
| **Feature category: GenTL System Module** , refer to Section 7.1, “GenTL system module” [p. 248] | |
| `TLVendorName`<br>*GUI name: Transport Layer Vendor* | GenTL producer vendor name<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `TLModelName`<br>*GUI name: Transport Layer Model* | GenTL producer model name<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `TLID`<br>*GUI name: Transport Layer ID* | GenTL producer ID<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `TLVersion`<br>*GUI name: Transport Layer Version* | GenTL producer version<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `TLPath`<br>*GUI name: Transport Layer Path* | GenTL producer path<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `TLType`<br>*GUI name: Transport Layer Type* | GenTL producer type (currently always reported as 'Mixed')<br>Type: enumeration<br>Possible values: `Mixed`, `Custom`, `GEV`<br>GUI visibility: beginner<br>Read-only feature |
| `GenTLVersionMajor`<br>*GUI name: GenTL Version Major* | Major version of the implemented GenTL specification<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |

| Name | Description |
|---|---|
| `GenTLVersionMinor`<br>*GUI name: GenTL Version Minor* | Minor version of the implemented GenTL specification<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevVersionMajor`<br>*GUI name: GigE Vision Version Major* | Major version of the implemented GigE Vision specification<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevVersionMinor`<br>*GUI name: GigE Vision Version Minor* | Minor version of the implemented GigE Vision specification<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `InterfaceUpdateList`<br>*GUI name: Update Interface List* | Update internal list of interfaces<br>Type: command<br>GUI visibility: beginner |
| `InterfaceSelector`<br>*GUI name: Interface Selector* | Selects an interface module to be accessed<br>Type: integer<br>GUI visibility: beginner |
| `InterfaceID`<br>[`InterfaceSelector`]<br>*GUI name: Interface ID* | Interface ID<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `GevInterfaceMACAddress`<br>[`InterfaceSelector`]<br>*GUI name: Interface MAC Address* | MAC address of the (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevInterfaceDefaultIPAddress`<br>[`InterfaceSelector`]<br>*GUI name: Interface Default IP Address* | Default IP address of the (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevInterfaceDefaultSubnetMask`<br>[`InterfaceSelector`]<br>*GUI name: Interface Default Subnet Mask* | Default subnet mask of the (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |

| Name | Description |
|---|---|
| `GevInterfaceDefaultGateway`<br>[`InterfaceSelector`]<br>*GUI name: Interface Default Gateway* | Default gateway of the (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| **Feature category: GenTL Interface Module** , refer to Section 7.2, "GenTL interface module" [p. 252] | |
| `InterfaceID`<br>*GUI name: Interface ID* | Interface ID<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `InterfaceType`<br>*GUI name: Interface Type* | Interface type<br>Type: enumeration<br>Possible values: `Custom`, `GEV`<br>GUI visibility: beginner<br>Read-only feature |
| `GevInterfaceGatewaySelector`<br>*GUI name: Interface Gateway Selector* | Selects gateway associated with a (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner |
| `GevInterfaceGateway`<br>[`GevInterfaceGatewaySelector`]<br>*GUI name: Interface Gateway* | Gateway of a (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevMACAddress`<br>*GUI name: Interface MAC Address* | MAC address of a (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevInterfaceSubnetSelector`<br>*GUI name: Interface Subnet Selector* | Selects subnet associated with a (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner |
| `GevInterfaceSubnetIPAddress`<br>[`GevInterfaceSubnetSelector`]<br>*GUI name: Interface Subnet IP Address* | Subnet IP address of a (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevInterfaceSubnetMask`<br>[`GevInterfaceSubnetSelector`]<br>*GUI name: Interface Subnet Mask* | Subnet mask of a (GigE Vision) interface<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |

| Name | Description |
|---|---|
| `DeviceUpdateList`<br>*GUI name: Update Device List* | Update internal list of devices<br>Type: command<br>GUI visibility: beginner |
| `DeviceSelector`<br>*GUI name: Device Selector* | Selects a device module to be accessed<br>Type: integer<br>GUI visibility: beginner |
| `DeviceID`<br>[`DeviceSelector`]<br>*GUI name: Device ID* | Device ID<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceVendorName`<br>[`DeviceSelector`]<br>*GUI name: Device Vendor Name* | Device vendor name<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceModelName`<br>[`DeviceSelector`]<br>*GUI name: Device Model Name* | Device model name<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceAccessStatus`<br>[`DeviceSelector`]<br>*GUI name: Device Access Status* | Access status of the device at time of last device list update<br>Type: enumeration<br>Possible values: `ReadWrite`, `ReadOnly`, `NoAccess`<br>GUI visibility: beginner<br>Read-only feature |
| `LvDeviceUserID`<br>[`DeviceSelector`]<br>*GUI name: Device User ID* | Device User ID<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `LvDeviceSerialNumber`<br>[`DeviceSelector`]<br>*GUI name: Device Serial Number* | Device identifier (serial number)<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `GevDeviceIPAddress`<br>[`DeviceSelector`]<br>*GUI name: Device IP Address* | IP address of the (GigE Vision) device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevDeviceSubnetMask`<br>[`DeviceSelector`]<br>*GUI name: Device Subnet Mask* | Subnet mask of the (GigE Vision) device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |

| Name | Description |
|---|---|
| `GevDeviceMACAddress`<br>[`DeviceSelector`]<br>*GUI name: Device MAC Address* | MAC address of the (GigE Vision) device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| **Feature category: GenTL Device Module** , refer to Section 7.3, "GenTL device module" [p. 256] | |
| `DeviceID`<br>*GUI name: Device ID* | Device ID<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceVendorName`<br>*GUI name: Device Vendor Name* | Device vendor name<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceModelName`<br>*GUI name: Device Model Name* | Device model name<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `DeviceType`<br>*GUI name: Device Type* | Device type<br>Type: enumeration<br>Possible values: `Custom`, `GEV`<br>GUI visibility: beginner<br>Read-only feature |
| `GevDeviceIPAddress`<br>*GUI name: Device IP Address* | IP address of the (GigE Vision) device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevDeviceSubnetMask`<br>*GUI name: Device Subnet Mask* | Subnet mask of the (GigE Vision) device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevDeviceMACAddress`<br>*GUI name: Device MAC Address* | MAC address of the (GigE Vision) device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `GevDeviceGateway`<br>*GUI name: Device Gateway* | Gateway of the (GigE Vision) device<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |

| Name | Description |
|---|---|
| `DeviceEndianessMechanism`<br>*GUI name: Device Endianess Mechanism* | Identifies the endianess mode<br>Type: enumeration<br>Possible values: `Legacy`, `Standard`<br>GUI visibility: guru |
| `LvGevDeviceStreamCaptureMode`<br>*GUI name: Device Stream Capture Mode* | Device stream capture mode<br>Type: enumeration<br>Possible values: `SystemDefault`, `Socket`, `FilterDriver`<br>GUI visibility: expert<br>Streamable feature, stored with user configuration sets |
| `LvGevFindMaxPacketSize`<br>*GUI name: Find Maximal Packet Size* | Determine the maximal usable packet size for streaming<br>Type: command<br>GUI visibility: guru |
| `LvGevPacketSizeValue`<br>*GUI name: Packet Size Value* | Streaming packet size to be verified using the Test Packet Size command<br>Type: integer<br>GUI visibility: guru |
| `LvGevTestPacketSize`<br>*GUI name: Test Packet Size* | Test if the selected packet size is suitable for streaming in current network configuration<br>Type: command<br>GUI visibility: guru |
| `LvGevPacketSizeTestSuccess`<br>*GUI name: Packet Size Test Success* | Reports success of the last packet size test command<br>Type: bool<br>GUI visibility: guru<br>Read-only feature |
| `LvGevCCTT`<br>*GUI name: Control Channel Transmission Timeout* | Controls the GigE Vision control channel transmission timeout value in milliseconds.<br>Type: integer<br>GUI visibility: guru<br>Unit: ms |
| `LvGevCCRC`<br>*GUI name: Control Channel Retry Count* | Controls the number of GigE Vision control channel command retransmissions allowed when a control channel command times out.<br>Type: integer<br>GUI visibility: guru |
| `StreamSelector`<br>*GUI name: Stream Selector* | Selects a stream module to be accessed<br>Type: integer<br>GUI visibility: beginner |

| Name | Description |
|---|---|
| `StreamID`<br>[`StreamSelector`]<br>*GUI name: Stream ID* | Stream ID<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| **Feature category: GenTL Stream Module** , refer to Section 7.4, "GenTL data stream module" [p. 260] | |
| `StreamID`<br>*GUI name: Stream ID* | Stream ID<br>Type: string<br>GUI visibility: beginner<br>Read-only feature |
| `StreamAnnouncedBufferCount`<br>*GUI name: Stream Announced Buffer Count* | Number of buffers announced for the data stream<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `StreamAcquisitionModeSelector`<br>*GUI name: Stream Acquisition Mode Selector* | Selects desired acquisition mode<br>Type: enumeration<br>Possible values: `Default`<br>GUI visibility: beginner |
| `StreamAnnounceBufferMinimum`<br>[`StreamAcquisitionModeSelector`]<br>*GUI name: Stream Announce Buffer Minimum* | Minimum number of buffers to be announced for selected acquisition mode<br>Type: integer<br>GUI visibility: beginner<br>Read-only feature |
| `StreamType`<br>*GUI name: Stream Type* | Stream type<br>Type: enumeration<br>Possible values: `Custom`, `GEV`<br>GUI visibility: beginner<br>Read-only feature |
| **Feature category: GenTL Buffer Module** | |
| The GenTL producer currently does not provide any features for this module. | |

*Table 7.1. Summary of all GenTL producer features (some of them available only for specific camera technologies)*

# 8. Connecting with 3rd party software packages

*Since the basic principles of integrating individual camera models in the 3rd party products are frequently same for all the camera families, this chapter discusses all the product lines.*

Our cameras connect to all GenTL compliant libraries, PicSight-GigE/PicSight-Smart cameras then also to all GigE Vision compliant libraries. The libraries include

- Halcon and ActivVisionTools from MVTec Software GmbH (GenTL and GigE Vision compliant)
- OpenCV, open source library originally developed by Intel (Simplon Source Code Generator provides samples to connect with OpenCV)
- LabView from National Instruments (GigE Vision compliant)
- VisionPro from Cognex (GigE Vision compliant)
- Common Vision Blox from Stemmer Imaging (GenTL and GigE Vision compliant)
- MIL (Matrox Imaging Library) from Matrox (GigE Vision compliant)
- MATLAB from MathWorks (GenTL and GigE Vision compliant)
- Adaptive Vision from Future Processing (Future Processing provides connectivity to PicSight-Smart cameras)
- Any other GenTL or GigE Vision compliant software.

The following sections provide basic instructions and some useful hints about using Leutron Vision cameras and Simplon GenTL Producer with some of the major 3rd party software packages. If you don't find instructions for the software library of your choice, then simply follow the official documentation of that software package or contact our support team in case of experiencing a problem.

## 8.1. Halcon (MVTec Software GmbH)

This section provides hints for successful integration of our cameras in the Halcon library (and ActivVisionTools). The details of the Halcon image acquisition interface is subject to change by MVTec Software GmbH. In case of any discrepancies, the official MVTec Software GmbH documentation overrides the info in this manual. If in doubts, please contact MVTec Software GmbH to get more accurate information.

Some of the points below might be targeted for use in the HDevelop environment. It should be well usable, however, for all Halcon users.

### 8.1.1. GigE Vision interface (PicSight-GigE, PicSight-Smart)

When working with our GigE Vision cameras, the “GigEVision” image acquisition interface of Halcon should be used. This interface accesses the GigE Vision cameras directly, no Leutron Vision software needs to be installed. During the initial tests, it might still be good idea to install the Simplon software package for easy camera configuration or possible troubleshooting.

If desired, however, the cameras might also be connected through the “GenICamTL” acquisition interface, as described in the next section.

- Be sure to always use the latest version of the GigEVision acquisition interface released for your Halcon version. It may contain important updates. Read its documentation carefully.
- To discover the GigE Vision cameras connected to the system, use the `info_framegrabber` operator:

  ```
  info_framegrabber ('GigEVision', 'info_boards', Information, ValueList)
  ```

  That call will rescan the network and detect all currently available GigE Vision cameras, providing various information about every detected camera. The most important part of the string is so called “unique name”, which is built as *`MacAddress_VendorName_ModelName`*, where any

non-alphanumeric characters are eliminated from vendor and model names. Example unique name can be `00186601975a_LeutronVision_PicSightP34MGigE`. The unique name is used when opening the camera in the `open_framegrabber` operator, passing the unique name in the `Device` parameter. Alternatively, the entire output string from the `info_framegrabber` can be used to open the camera as well.

The `info_framegrabber` operator has an alternative form:

```
info_framegrabber ('GigEVision', 'device', Information, ValueList)
```

In this case it returns just the unique names, without the additional information.

To make the discussion complete, the cameras can be also opened using the *Device User ID* string (sometimes also known as camera “nickname”). Once you assign unique user ID's to all used cameras, referring them using those ID's might be easier and more straightforward than using the Halcon “unique names”. Of course, this mechanism can only work reliably, if the user ID's for individual cameras are truly unique (no duplicities).

When you need to rescan the system to discover newly connected cameras, just call the `info_framegrabber` operator again.

- The PicSight-GigE/PicSight-Smart cameras might not be properly discovered if their IP configuration does not match the network interface they are connected to, for example if they are configured for different subnet. In such case, it's recommended to use the Simplon GigE Vision Configuration Tool to configure all the cameras first, before using them in Halcon.

## 8.1.2. GenTL interface (CheckSight/CheckSight-II, optionally PicSight-GigE/PicSight-Smart)

When working with our CheckSight/CheckSight-II cameras, the “GenICamTL” image acquisition interface of Halcon should be used. This interface accesses the cameras through Simplon GenTL Producer, according to the GenICam GenTL standard. Therefore the Simplon package has to be installed in the system.

*Halcon will find and use the Simplon GenTL Producer automatically. The GenTL producers are (according to the standard) registered in the system through the `GENICAM_GENTL32_PATH`/`GENICAM_GENTL64_PATH` environment variable. This is done automatically by the Simplon installer. However, on some Linux systems not supporting the `/etc/profile.d` mechanism, this might fail. In such case, you will need to set the environment variable manually according to the conventions used in your Linux distribution. The variable should point to the directory containing the Simplon GenTL Producer, `liblv.gentl.cti`. This directory is by default `/opt/simplon/cti` on 32-bit, `/opt/simplon/cti64` on 64-bit systems.*

- Be sure to always use the latest version of the GenICamTL acquisition interface released for your Halcon version. It may contain important updates. Read its documentation carefully.
- To discover the cameras connected to the system, use the `info_framegrabber` operator:

```
info_framegrabber ('GenICamTL', 'info_boards', Information, ValueList)
```

That call will rescan the system and detect all cameras currently visible through the “GenTL producers” installed in the system, providing various information about every detected camera. The three most important components of the information string are the GenTL “device ID” of the camera, the ID of the “GenTL interface” the camera was discovered on and finally the corresponding GenTL producer itself (identified by its full path). These three components are enough to open the camera using the `open_framegrabber` operator. The string passed to the operator in the `Device` parameter should contain these three components, using similar syntax as returned from `info_framegrabber`, eg. `device:DeviceID`

`interface:`*`InterfaceID`* `producer:`*`ProducerPath`*. Alternatively, the entire output string from the `info_framegrabber` can be used to open the camera as well.

The `info_framegrabber` operator has an alternative form:

```
info_framegrabber ('GigEVision', 'device', Information, ValueList)
```

In this case it returns just the GenTL device ID's, without the additional information. The device ID unequivocally identifies the camera, so it can be also used to open it. However, this mechanism currently only works in Halcon when the camera is detected on the first interface of the first GenTL producer, therefore it's not fully reliable and we recommend to use the full syntax (device/interface/producer).

When you need to rescan the system to discover newly connected cameras, just call the `info_framegrabber` operator again. Note that Halcon currently avoids rescanning the GenTL interfaces where one ore more cameras are already open. This might improve in future.

- When opening the camera, you can adjust the number of acquisition buffers the Halcon acquisition interface will allocate for the camera. In most cases the default value (`3`) will be just fine, but in some scenarios it might be useful to allocate more buffers to prevent acquisition overflows, eg. when the system gets temporarily under a heavy load and cannot process the incoming images as they are coming. Larger number of acquisition buffers can help to overcome short peaks of the processing load.

  The number of buffers might be changed through the `Generic` parameter of the `open_framegrabber` operator. Set this parameter to `num_buffers=`*`N`*, where *`N`* is the desired number of buffers.

- It is possible to control also the features of the individual GenTL modules corresponding with the open camera: the Device module, its parent Interface module and the System module representing the GenTL producer itself. In such case, the module name in square brackets should prefix the feature name: `[Device]`*`FeatureName`*, `[Interface]`*`FeatureName`*, `[System]`*`FeatureName`*.

  Adjusting the parameters of the Stream and Buffer GenTL modules is not supported by the Halcon GenTL interface.

## 8.1.3. Common notes

- During the development phase, it might be good idea to switch on the low-level error reporting mechanism of Halcon, it can help for troubleshooting.

  ```
  set_system ('do_low_error', 'true')
  ```

  Note however, that in some situations, such as when switching on the chunk data mode or when using the variable payload size functionality, the “low-error” mechanism of Halcon might trigger a warning that the payload size (ie. size of the image data) reported by the camera is bigger than the size calculated by Halcon. Please ignore this warning, the payload size reported by the camera is always correct — the size increase is legitimate in certain operating modes.

- All integer-based device features are internally handled as signed, with native size on the current platform. This can bring certain limitations, in particular on 32-bit systems. Whenever working with integers that might exceed the 32-bit range or that are by nature unsigned, keep this in mind. The features include for example:
  - Timestamps and related features.
  - MAC and IP addresses.
  - 32-bit masks and bitfields, such as *Line Status All, User Output Value All* or similar.
  - Generic unsigned integer features used by PicSight-Smart applications.

To input an integer in hexadecimal form, use the `0x` prefix:

```
Result := 0xFF
```

To get a value displayed in hexadecimal form, use the `$'x'` appendix with the variable:

```
HexValue := Value$'x'
```

- When trying to set an integer or float value which is out of the range supported by the camera, the Halcon acquisition interface will not raise an error, but round the value to the closest supported one.
- Chunk data nor event data are currently supported by Halcon.
- Halcon image acquisition interfaces make significant efforts to allow changing any camera feature value at any time, including the features that would be “locked” (read-only) by the camera during the acquisition. When the application attempts to write to a feature that is currently read-only, Halcon stops the acquisition to check whether the camera would unlock the feature and eventually writes to it. Then it restarts the acquisition.

  This attitude brings a good deal of flexibility, but it also comes for a price. Starting and stopping the acquisition generates certain overhead on all cameras — in particular with the DMA based devices such as CheckSight/CheckSight-II. In such case the acquisition buffers must be locked into the physical memory when starting the acquisition, and that is potentially time consuming operation, depending on the timing requirements of the application. Furthermore, after changing certain parameters, the size of the data acquired for each image (“payload size”) can change — then the Halcon interface will need to reallocate all the acquisition buffers, which yields additional overhead. All of these operations might of course also fail at any time, depending on the actual status of the system resources — all this in the middle of acquisition.

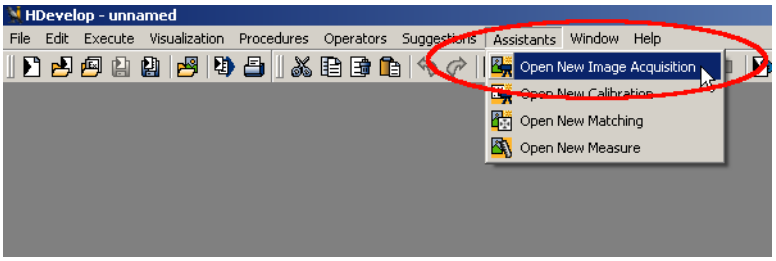
  For all these reasons we recommend to configure the features normally locked during the acquisition only at the beginning and don't touch them again during the acquisition — unless really necessary or unless the timing requirements of the application are not too strict. When not sure if a given feature is locked during the acquisition, the easiest way is to verify in the Simplon Explorer — after opening the camera and starting the acquisition, part of the features in the feature tree will become “greyed”, signalling that they were locked by the camera.

## 8.1.4. Halcon Image Acquisition Assistant

When starting with camera integration in Halcon, you can either start with one of the samples delivered with Halcon or use the Image Acquisition Assistant (tool built in the Halcon HDevelop development environment) to create the application skeleton. When finished with tuning the HDevelop script, the program can be exported to programming languague of your choice.

In the few steps below, we'll briefly demonstrate how to use the Image Acquisition Assistant. Note that this section does not substitute the Halcon documentation, it's just a brief introduction with some useful hints.

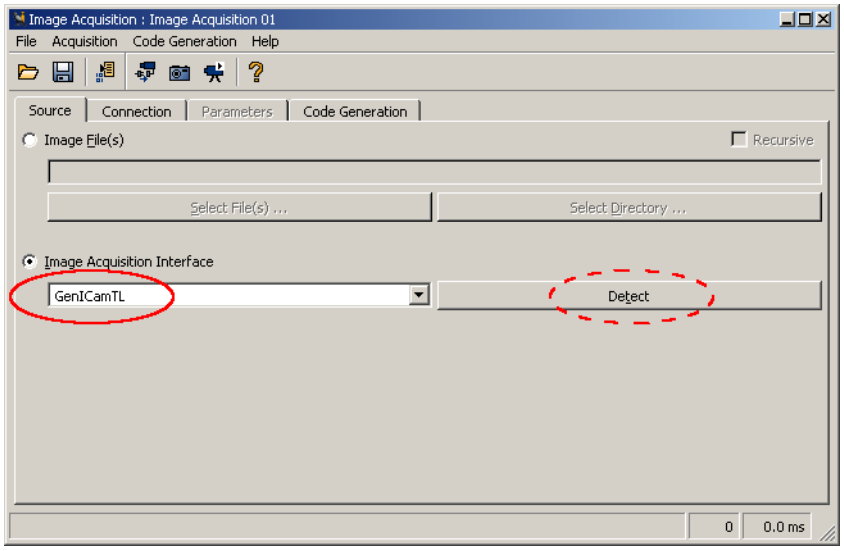
1. Start HDevelop and open a new Image Acquisition Assistant from the menu Assistants → Open New Image Acquisition.


HDevelop - unnamed
File Edit Execute Visualization Procedures Operators Suggestions Assistants Window Help
Open New Image Acquisition
Open New Calibration
Open New Matching
Open New Measure

2. Select the Halcon image acquisition interface you want to use to control the camera(s). Depending on the camera type(s), select either “GenICamTL” or “GigEVision” interface.

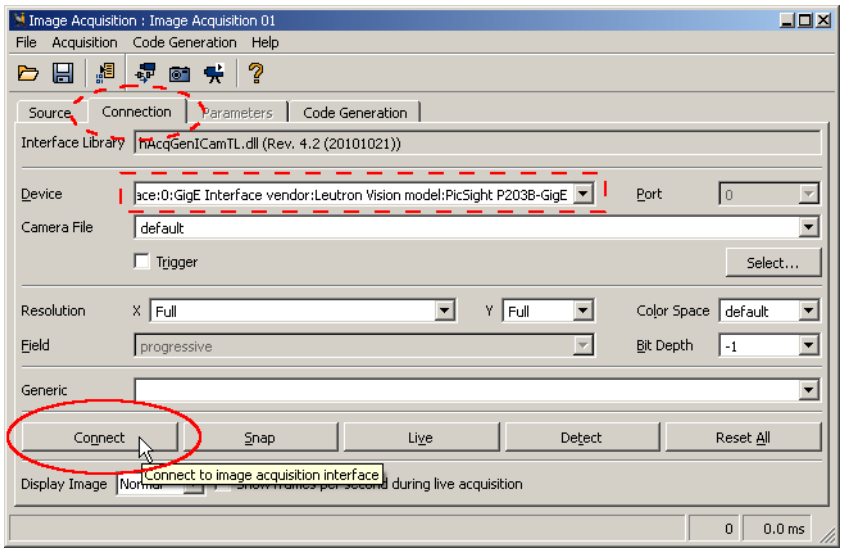
   The assistant will query the list of cameras available through that interface and allow to connect one of them at the Connection tab.

   It's possible to rescan the list of connected cameras later by clicking the Detect button. Note however, that current implementation of the Halcon GenICamTL interface does not attempt to discover cameras connected to interface on which one ore more cameras are already open. As a consequence, after opening a camera on a GenTL interface, you won't be able to start a new Image Acquisition Assistant and open another camera on the same interface — the assistant woudl not discover it. This behaviour might improve in a future version of Halcon GenICamTL acquisition interface.



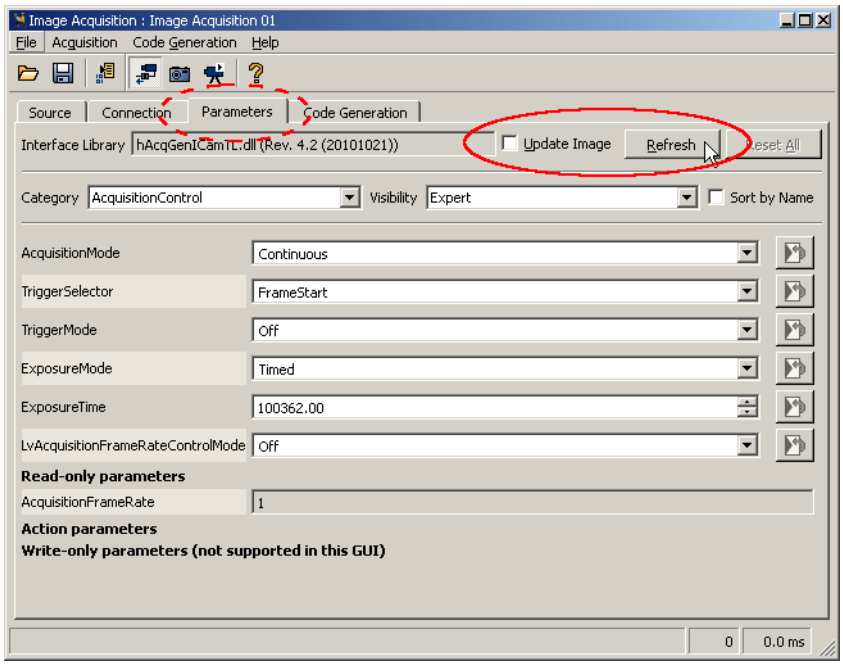

3. Switch from the Source to the Connection tab of the acquisition assistant. By the top of the window, you'll see the Device combobox listing the discovered cameras.

   Select the one you wish to work with and click the Connect button. The assistant will open the connection to the camera, retrieve it's feature tree and allow to control the features or acquire images.



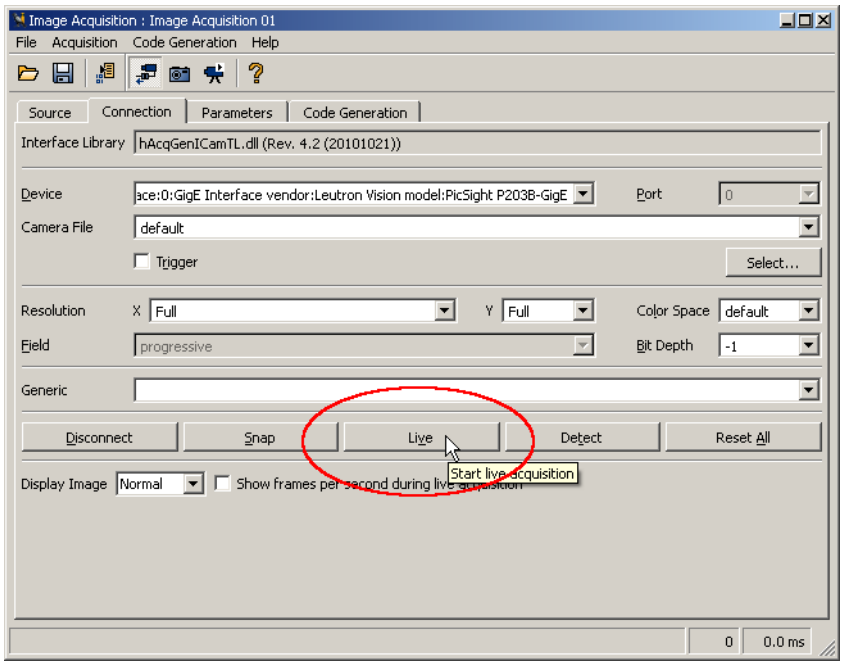

4. Switch to the Parameters tab of the assistant. Here you can fully configure the camera, the GenTL producer and even the acquisition related parameters of the Halcon itself. Some important hints:

   - The features come in three visibility levels, beginner-expert-guru. You can control them through the Visibility combobox. At the beginner level, only the basic features will be available, at the guru level all the features (including the typically “don't touch” ones) will appear. We recommend to work at the expert level in most cases.
   - Using the Category combobox the feature list can be narrowed down to a single feature category. This might make the orientation a lot easier.
   - We recommend to clear the Update Image checkbox while configuring the camera. When enabled, the assistant will attempt to acquire an image after every feature change (which frequently is not required at all). This brings an overhead in repeated acquisition start/stop loops. Indirectly, starting/stopping the acquisition might change access mode of some features (certain features are locked during acquisition). Finally, in triggered mode the acquisition won't work anyway unless you supply the trigger.
   - Halcon Image Acquisition Assistant does not handle the feature dependencies automatically. For example if changing one feature enables/disables another feature, it will not automatically appear/hide in the feature tree. To update the feature list (after changing the configuration or whenever in doubts), click the Refresh button. The feature tree will be reloaded with proper access modes.

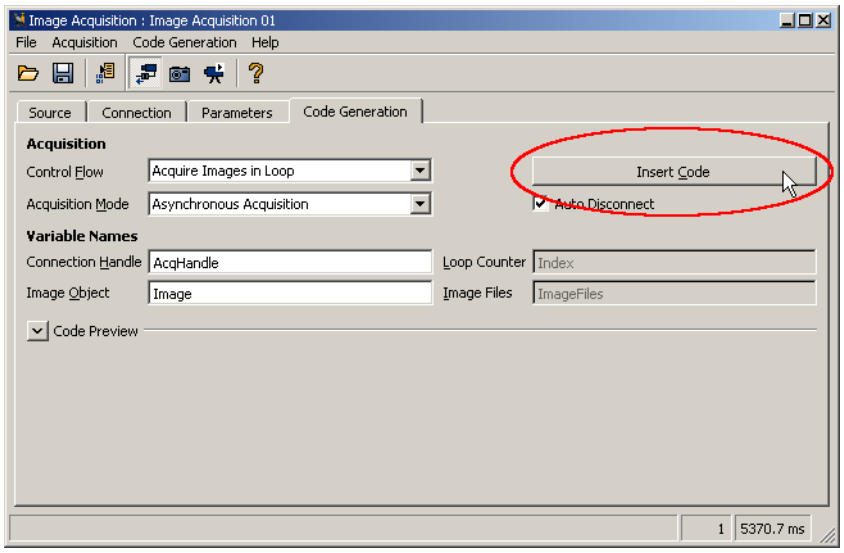



5. When finished with the camera configuration, you can test the image acquisition using the Live or Snap buttons in the Connection tab of the assistant.

   You can repeat changing the camera configuration until the desired final status is reached.




6. When finished configuring the camera, you can let the assistant to generate the application code for you. Proceed to the Code Generation tab and click the Insert Code button. The assistant will generate code that finds and opens the selected camera, adjusts all the camera parameters you have changed in the assistant and then start a simple acquisition loop. By default it will automatically disconnect from the camera so that you can immediately start playing with the generated script. The script can serve as a very good starting point for the actual application.




# 8.2. Common Vision Blox (Stemmer Imaging)

This section provides hints for successful integration of our cameras in the Common Vision Blox library. The details of the Common Vision Blox image acquisition interface is subject to change by Stemmer Imaging. In case of any discrepancies, the official Stemmer Imaging documentation overrides the info in this manual. If in doubts, please contact Stemmer Imaging to get more accurate information.

## 8.2.1. GigE Vision interface (PicSight-GigE, PicSight-Smart)

When working with our GigE Vision cameras, the Common Vision Blox image acquisition interface can access the GigE Vision cameras directly, no Leutron Vision software needs to be installed. During the initial tests, it might still be good idea to install the Simplon software package for easy camera configuration or possible troubleshooting.

If desired, however, the cameras might also be connected through the Simplon GenTL Producer, as described in the next section.

Common Vision Blox is internally using the GenTL to access the image acquisition interfaces, including its own ones (similarly as Simplon), so the functionality and user experience will be practically the same, regardless if connecting through Simplon GenTL Producer or the Common Vision Blox internal GigE Vision interface.

- Be sure to always use the latest version of the Common Vision Blox, including any available service packs (“hotfixes”). They may contain important updates. Read its documentation carefully.
- The PicSight-GigE/PicSight-Smart cameras might not be properly discovered if their IP configuration does not match the network interface they are connected to, for example if they are configured for different subnet. In such case, it's recommended to use the Simplon GigE Vision Configuration Tool (or a corresponding Common Vision Blox utility) to configure all the cameras first, before using them in Common Vision Blox.
- Chunk data are not supported by Common Vision Blox.
- Event data are supported. However, the Common Vision Blox is using a custom event delivery mechanism, not compatible with other GenTL producers. Therefore the event data delivery will work reliably only over the Common Vision Blox internal GigE Vision interface.

Common Vision Blox is expected to align to the GenTL event delivery mechanism in the future, you might wish to observe the new available updates.

## 8.2.2. GenTL interface (CheckSight/CheckSight-II, optionally PicSight-GigE/PicSight-Smart)

When working with our CheckSight/CheckSight-II cameras, the Common Vision Blox has to access the camera through the Simplon GenTL Producer according to the GenICam GenTL standard. Therefore the Simplon package has to be installed in the system.

*Common Vision Blox is available for Windows operating systems. The Linux version is available only for the 64-bit platform, while the CheckSight/CheckSight-II is 32-bit. Therefore Linux Common Vision Blox cannot be currently used on CheckSight/CheckSight-II. If interested in the Linux operating system, please contact Stemmer Imaging to get the up to date information about plans to support 32-bit Linux version.*

*Common Vision Blox will find and use the Simplon GenTL Producer automatically. The GenTL producers are (according to the standard) registered in the system through the* `GENICAM_GENTL32_PATH/GENICAM_GENTL64_PATH` *environment variable. This is done automatically by the Simplon installer. However, on some Linux systems not supporting the* `/etc/profile.d` *mechanism, this might fail. In such case, you will need to set the environment variable manually according to the conventions used in your Linux distribution. The variable should point to the directory containing the Simplon GenTL Producer,* `liblv.gentl.cti`*. This directory is by default* `/opt/simplon/cti` *on 32-bit,* `/opt/simplon/cti64` *on 64-bit systems.*

- Be sure to always use the latest version of the Common Vision Blox, including any available service packs (“hotfixes”). They may contain important updates. Read its documentation carefully.
- Chunk data are not supported by Common Vision Blox.
- Event data are supported. However, the Common Vision Blox is using a custom event delivery mechanism, not compatible with other GenTL producers. Therefore we strongly recommend to not use any device event related functionality within Common Vision Blox, it might cause serious problems.

  Common Vision Blox is expected to align to the GenTL event delivery mechanism in the future, you might wish to observe the new available updates.

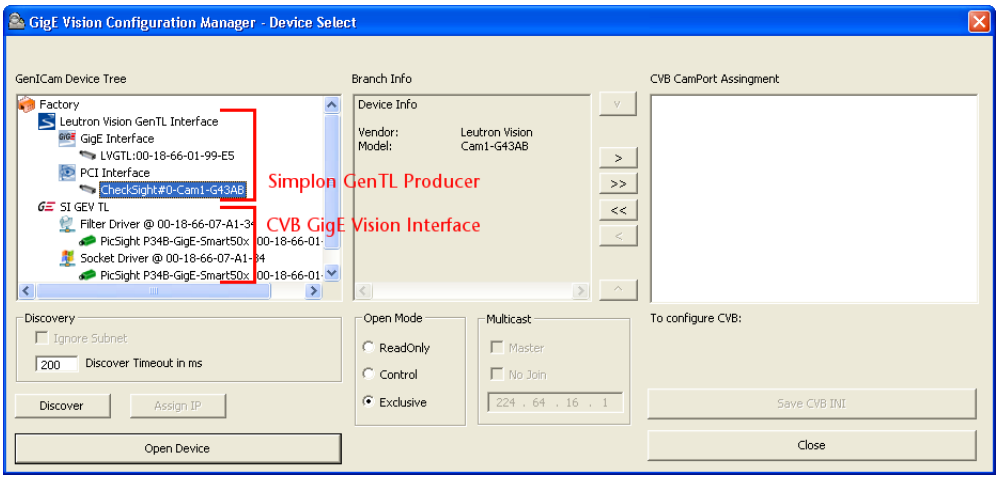
## 8.2.3. Getting started quickly

The Common Vision Blox comes with documentation describing how to work with the cameras connecting through the “GenICam Driver” — the Common Vision Blox component responsible for communication over the GenTL interface. That driver will be used to control our cameras, either through Simplon GenTL Producer or through Common Vision Blox own GigE Vision interface.

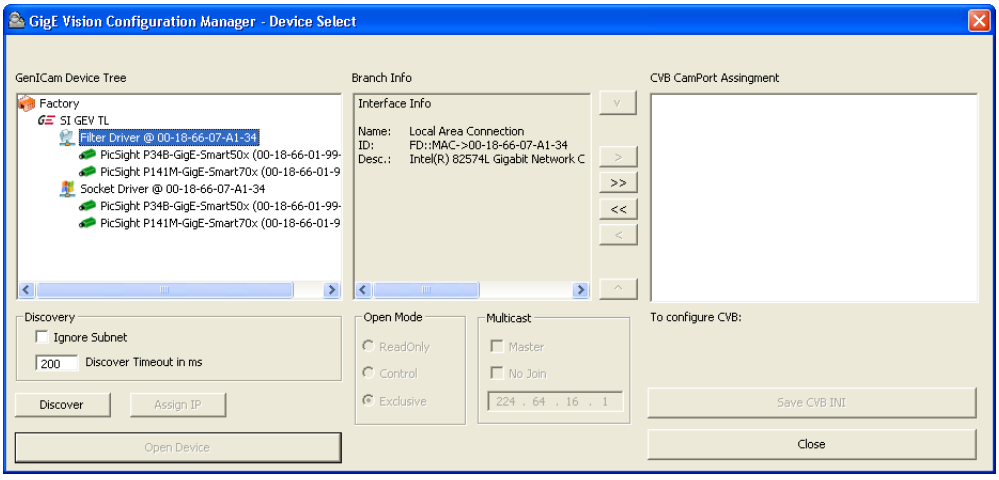
This section is not intended to replace the Common Vision Blox documentation, but rather provide step-by-step introduction on how to test and integrate our cameras into the Common Vision Blox environment. We still recommend to read the Common Vision Blox documentation carefully.

For the first test you can use the tool called GigE Vision Configuration Manager. Despite it's name, the tool is not working just with GigE Vision cameras. The executable path is `%CVB%\Hardware\StemmerImaging\siFilterDriver\GEVConfigManager.exe`, where `%CVB%` stands for Common Vision Blox installation directory.

When loaded, the tool displays the list of cameras discovered in the system. It will show cameras discovered through the Simplon GenTL Producer (both PicSight and CheckSight cameras) and through the Common Vision Blox native GigE Vision interface. Note that the PicSight cameras will be discovered multiple times, through both Simplon and Common Vision Blox interfaces.




When the Simplon package is not installed, only the cameras discovered through the Common Vision Blox native acquisition interface will be recognized. Since it is GigE Vision compliant, it will detect any PicSight-GigE and PicSight-Smart cameras. You can select whether to communicate with the camera through the Common Vision Blox filter driver or through a simple socket interface.




The current camera status is expressed through the camera icons:

- Green icon — the camera is ready for connection.
- Blue icon — the camera is accessible, but not available in the moment, usually because it is already opened in another application (possible even from another computer).
- Red icon — the camera is not accessible. For GigE Vision cameras this usually means that the camera is currently configured for a different subnet than the computer itself, therefore they cannot communicate directly.

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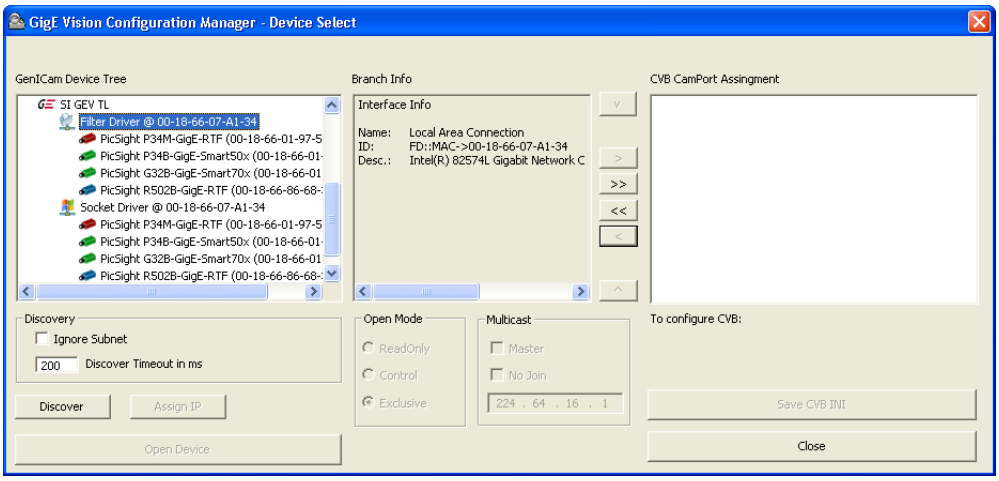
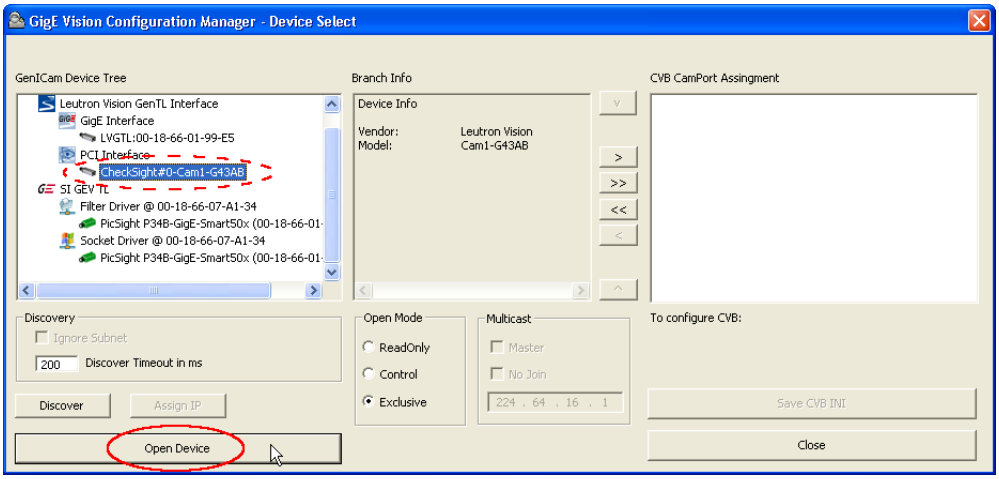
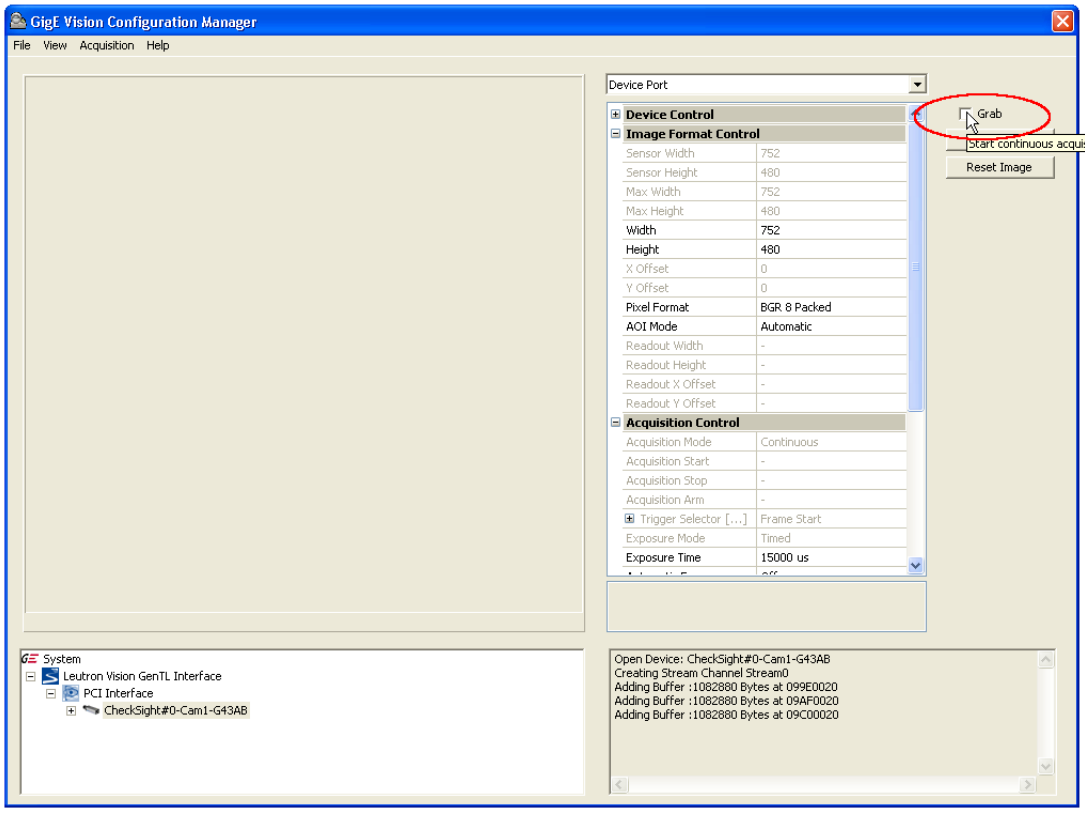


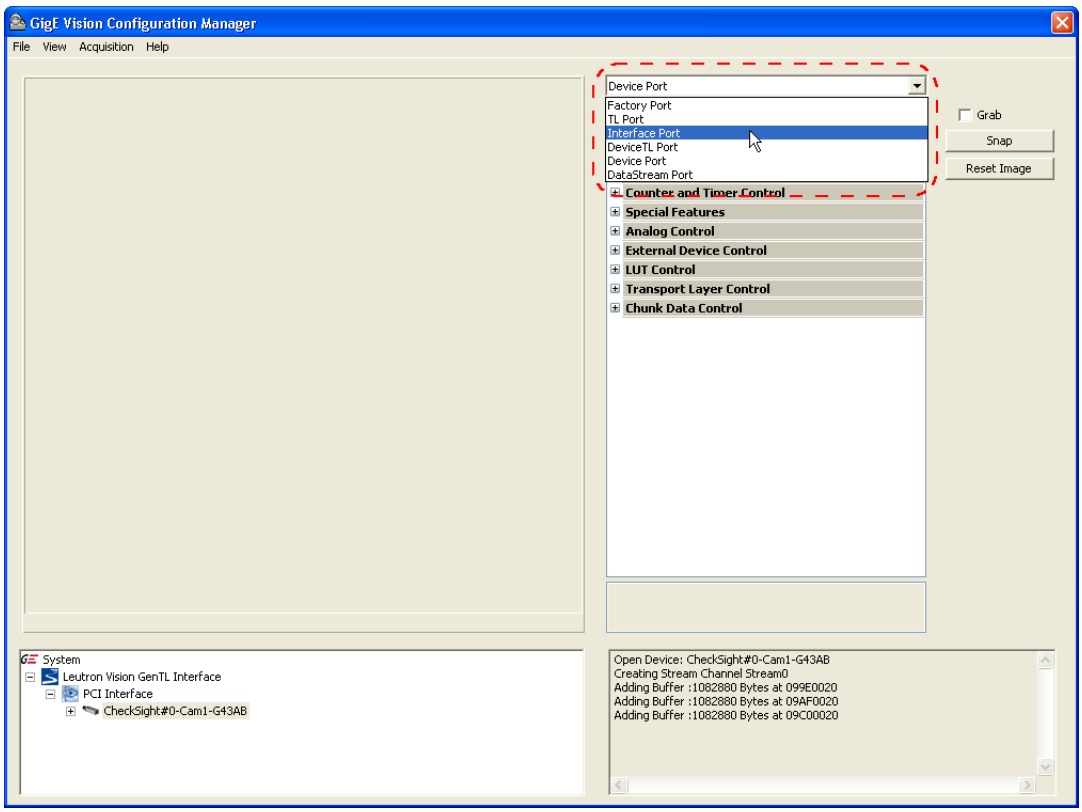

To connect to the camera, simply select it in the list and click the Open Device button.




The tool will connect to the camera and display it's feature tree. Now you can configure the desired camera parameters — and when finished, start acquisition by clicking the Grab checkbox. Clicking it again will stop the acquisition.



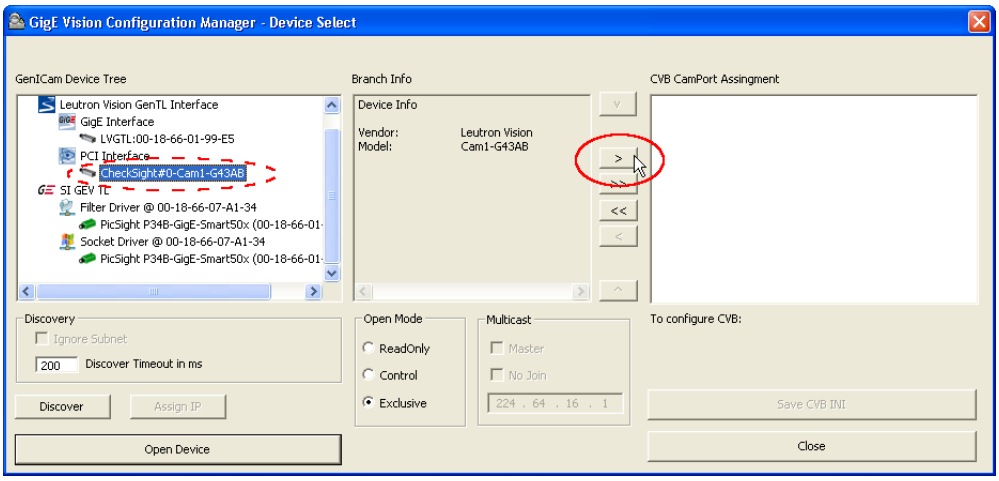

Except of the feature tree of the camera itself, feature trees of the individual components of the GenTL producer controlling the camera can be also accessed. The individual feature trees are selectable through the combobox by the top of the window.



When finished with testing the camera functionality in the GigE Vision Configuration Manager, you can use the tool to configure the camera(s) for use through the Common Vision BloxGenICam Driver. Note that the Common Vision Blox libraries and tools will access the cameras exactly through this driver.

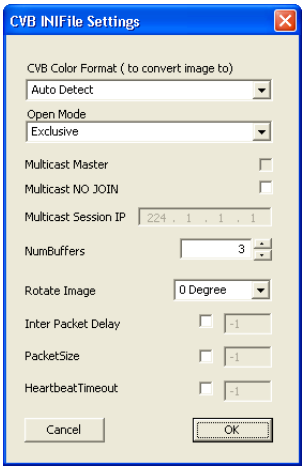
The Common Vision Blox acquisition drivers are stored in `%CVB%\Drivers` directory. The GenICam Driver binary file name is `GenICam.vin` and its configuration file `GenICam.ini`. The configuration file mainly lists the cameras to be used and their connection parameters. It can be created from the GigE Vision Configuration Manager.

Select the camera(s) you want to store in the driver's configuration file and click the > to copy them from the GenICam Device Tree panel to CVB CamPort Assignment.

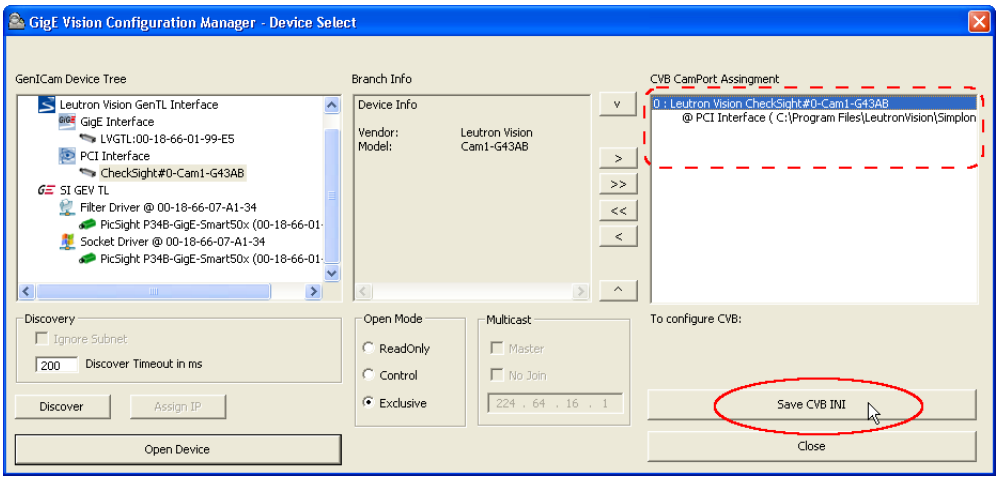



Double-clicking the camera entry in the CVB CamPort Assignment panel pops a dialog allowing to configure some parameters controlling how the driver will handle the camera.

Part of the parameters are GigE Vision specific (packet size, inter-packet delay, heartbeat timeout). Other parameters are universal, such as the `NumBuffers` parameter. It specifies how many acquisition buffers should the driver allocate for the camera. Note that when your application generates a variable processing load, it might get behind the acquisition rate in processing peaks. Increasing the number of acquisition buffers can help to overcome these peaks and help to prevent loosing images. Note also that when the driver will do color format conversion, that number of buffers will be actually allocated twice, one set for the actually acquired data, the other for the processed ones.

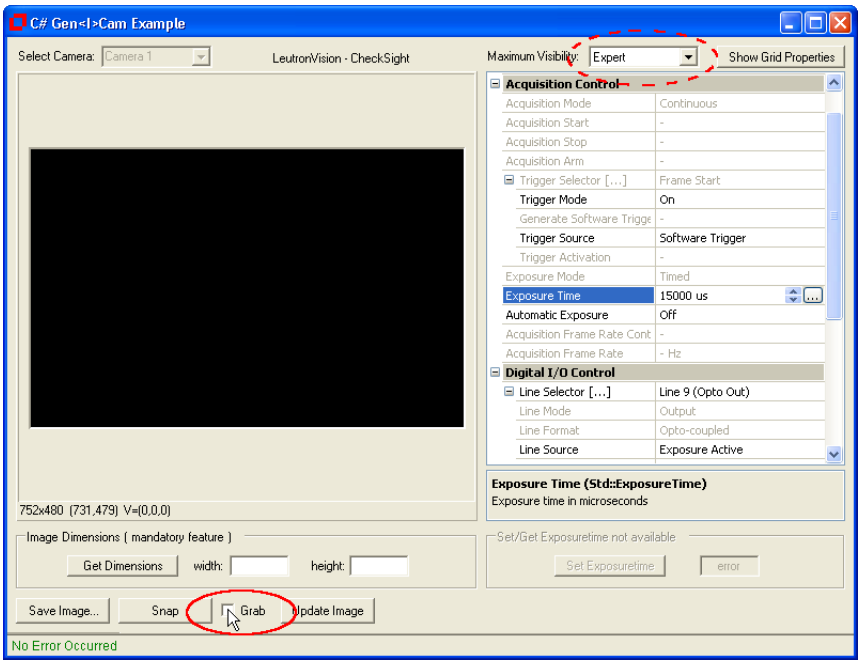



When the configuration is finished, it can be written to the driver's configuration file by clicking the Save CVB INI button.




The configuration can be verified for example through one of the Common Vision Blox sample programs. As an example, let's take the “C# GenICam Example”. Start it through system menu Start → Programs → STEMMER IMAGING → Common Vision Blox → Hardware → GenICam → C# GenICam Example.

When started, the sample will automatically open the camera configured in the driver's configuration file — provided that it is still available. It will allow to control all the camera features and then start the camera acquisition — again through the Grab checkbox.




At this point, the system should be verified and configured for use in a real Common Vision Blox application. The details how to access the cameras programmatically through the Common Vision Blox acquisition interface are beyond scope of this manual. Please refer to the official Common Vision Blox documentation.

## 8.3. VisionPro, CVL (Cognex)

The *Simplon Imaging Device Adapter for Cognex Software* allows to access the Leutron Vision hardware from Cognex software (VisionPro 5.2 or later or CVL 6.6 or later), through the Simplon library. This adapter is provided namely as a solution for running Cognex software on CheckSight; for

Leutron Vision GigE cameras can be used the GigE-Vision protocol, which is directly supported by Cognex software and thus this adapter is not needed.

## 8.3.1. Installation

The adapter is installed by Simplon Setup from version 1.00.074. It consists of 2 files:

- `lv.cognex.adapter.dll`, which is installed to the `Simplon\Bin` folder of Simplon
- `lv.cognex.adapter.ini`, which is installed to the Simplon user folder (on Windows XP is this folder the same as `Simplon\Bin`).

The Setup also modifies the Windows Registry to make the adapter visible to Cognex software. This includes the following 4 values added to 32-bit registry:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Cognex\AIK\AdapterLeutronVision]
"UseExe"=dword:00000001
"ServerNameBase"="Cognex.AIKserver.AdapterLeutronVision."
"PoolSize"=dword:08000000
"LibName"="C:\\Prg\\Simplon\\Bin\\lv.cognex.adapter.dll"
```

Note that the `PoolSize` is officially recommended to have a value `0x4000000`, however, when working with large color images (1600x1200 and larger), this size may not be sufficient and you can experience a crash (it is a known bug in Cognex software). Thus the Setup sets the value `0x8000000` instead.

**Important note**: When you install Cognex software on CheckSight, be sure you do not accidentally install the support for the FG8600 frame grabber. To be sure, please verify after the Cognex software installation that there is no FG8600.sys driver file installed in Windows\System32\Drivers directory. Also be sure you do not have installed the Leutron Vision LV-SDS. These drivers are in conflict with Simplon and can cause system hang.

## 8.3.2. Functionality

The Adapter provides the functionality required by the Cognex *Acquisition Integration Kit*. As this API is quite simple, some additional parameters, not covered by the API, can be specified in the `lv.cognex.adapter.ini` file. The contents of the file is as follows:

```
[Interfaces]
ListGigEDevices=0
ListPciDevices=1

[Options]
NumberOfBuffers=10
SupportRoi=0
FeatureVisibility=0
DontStopInNonContinuous=1
DelayAfterStartAcq=50

[Device]
DeviceSettings=
DefaultExposure=10000
DefaultImageWidth=640
DefaultImageHeight=480
DefaultTriggerSource=Line1

[PCI-Interface-CheckSight-P32B]
Settings=C:\Prg\Simplon\Bin\PCI-Interface-CheckSight-P32B.cam
```

```
DefaultExposure=16019
DefaultImageWidth=656
DefaultImageHeight=492
```

### 8.3.2.1. Interfaces

In this section you can specify, which interfaces are to be scanned for devices. Typically, the Cognex software installs support for GigE camera, so if you enable `ListGigEDevices`, then the GigE camera would appear in the list twice – once through the GigE-Vision protocol, once through the Simplon (GenTL) interface. As this adapter is primarily designed for CheckSight, which is a PCI device, the `ListPciDevices=1` assures its device(s) will be listed.

### 8.3.2.2. Options

**NumberOfBuffers**: Defines how many buffers should be used by Simplon for the acquisition. The higher number of buffers may be needed in case your Cognex application may not pick in time the acquired images; they are queued and the higher number of images means a longer queue. The default value is 10, in case you use triggered or non-continuous acquisition and pick images in time, the number of buffers can be reduced to 3.

**SupportRoi**: Enables the support of hardware ROI. This should be enabled only if the given sensor supports the hardware ROI (AOI). You can check this in Simplon Explorer – in such case the `LvDevice_LvAOIMode` feature can be set to `LvAOIMode_Manual`, and `LvDevice_OffsetX`, `LvDevice_OffsetY` can be set to a non-zero value. On CheckSight the support of hardware ROI is useful only in case the sensor provides faster acquisition with reduced ROI; on GigE cameras the HW ROI can also save network traffic. If the ROI is not hardware supported, the Cognex libraries make the ROI automatically by software.

**FeatureVisibility**: The device features, as you can see them in Simplon Explorer, are also available as Features of the imaging device in the Cognex library. Enumeration of the features consumes some time, so if you want to reduce the device connection time, you can limit the available features by selecting the level. The levels correspond to the levels visible in Simplon Explorer. The lower level, the faster is the connection of the device. Beginner = 0, Expert = 1, Guru = 2. See also the Features chapter.

**DontStopInNonContinuous**: When in non-continuous mode, an application usually calls `StartAcquisition()` function and after obtaining the image it calls the `StopAcquisition()` function. Starting and stopping the acquisition is time consuming, so the adapter introduces a mode, in which it postpones the StopAcquisition() call to the moment when it is really needed. If the next `StartAcquisition()` comes just after `StopAcquisition()` without change of any feature or other parameters, these 2 calls are skipped (only the acquisition of a new image is triggered) and time is saved. This enhancement is available only in non-continuous and non-triggered mode. You can disable it by this option.

### 8.3.2.3. Device

**DeviceSettings**: Here you can specify the name of the settings file for the device. You can create this file in Simplon Explorer by saving the settings in menu "Camera -> Save camera settings". This enables you to load device settings, which you can comfortably set in Simplon Explorer. Common things like white balance, gain etc., can be set in Simplon Explorer and saved to this file. Note that the attempt to load these settings for a different device may cause an error. The file must be specified with a full path.

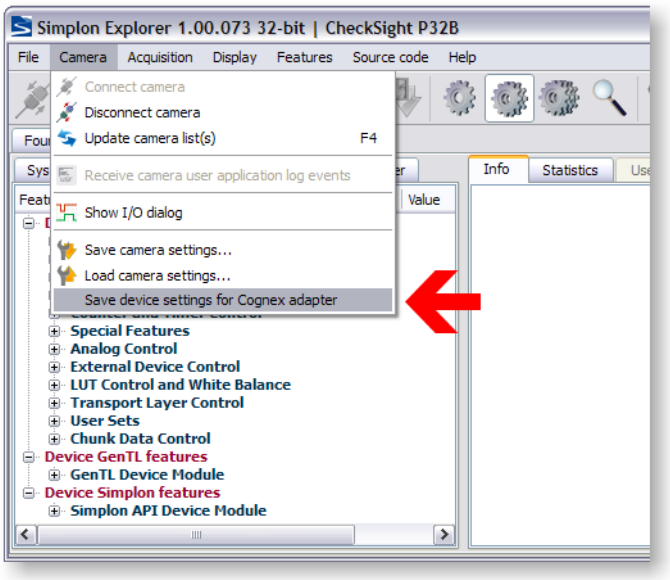
**DefaultExposure**, **DefaultImageWidth**, **DefaultImageHeight**: The Cognex software requires to obtain these values *before* the device is opened. Thus they are read from this file.

**DefaultTriggerSource**: As Leutron Vision devices usually have more trigger inputs, you can specify here which one will be used when the HW trigger is configured in Cognex software. On CheckSight the following inputs are available: Line1 - Opto In, Line2 - Opto In, Line3 - Opto In,

Line4 - Opto In, Line17 - TTL In, Line18 - TTL In. You can also set the trigger input by a feature, see the next chapter.

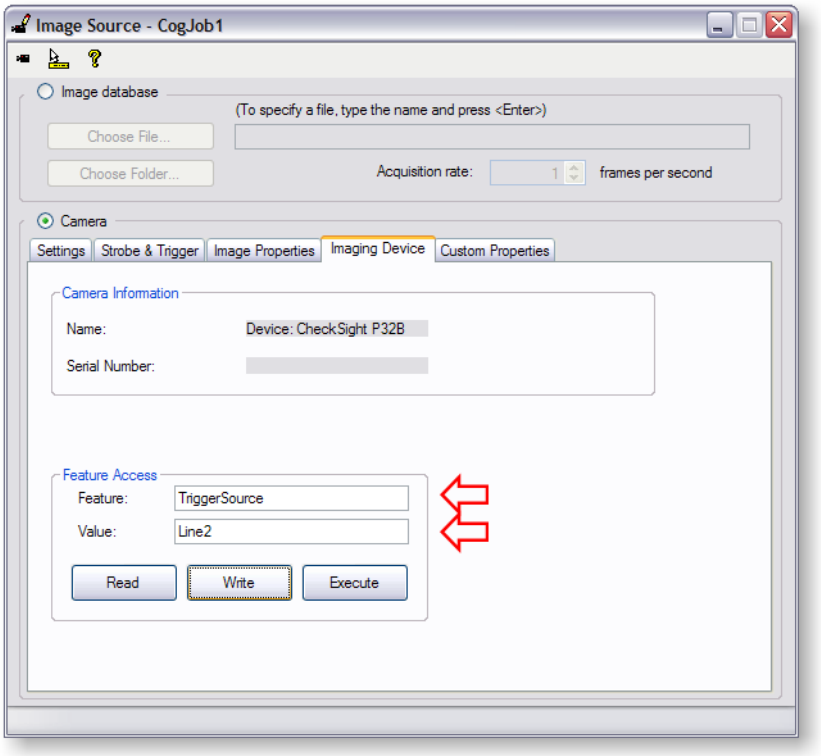
## 8.3.3. Settings saved from Simplon Explorer

The part printed in italics shows an example of settings, which can be saved easily from Simplon Explorer by the menu "Camera -> Save device settings for Cognex adapter". The section name is composed from Interface ID and Device ID, so the contents of this section is used only in case the same device is opened. If this section exists for the device, it has a precedence over the [Device] section contents.

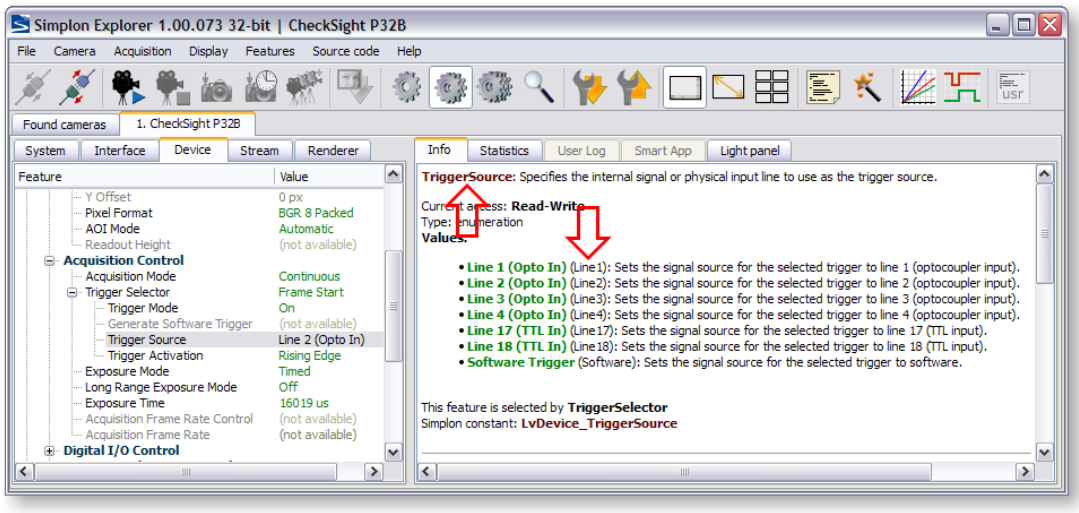



## 8.3.4. Features

The Device features visible in Simplon Explorer are also available through the Adapter. The feature is identified by its Gen-i-cam name and in case of enumerations you can also see the available values in Simplon Explorer. For example for setting the trigger source, the feature name is TriggerSource, and value is Line1, see the arrows in the screen shot. See also FeatureVisibility in the INI file.




For example in VisionPro QuickBuild you put these strings in the feature access dialog:




# 8.4. OpenCV

The OpenCV library does not provide native support for GenTL or GigE Vision interfaces, however, it is possible to integrate OpenCV with Simplon API easily. A simple example demonstrating, how to deliver the images acquired through the Simplon API interface to the OpenCV functions, can be created through the Simplon Source Code Generator — use the OpenCV sample in the Project Generation Wizard:

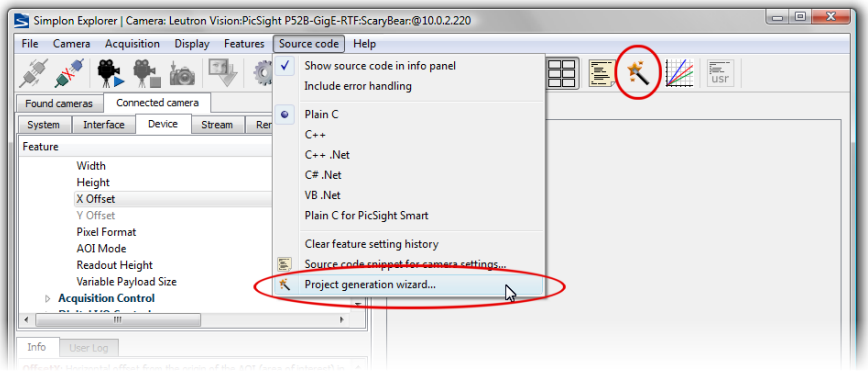



*Figure 8.1. Simplon Explorer — start the Project Generation Wizard*

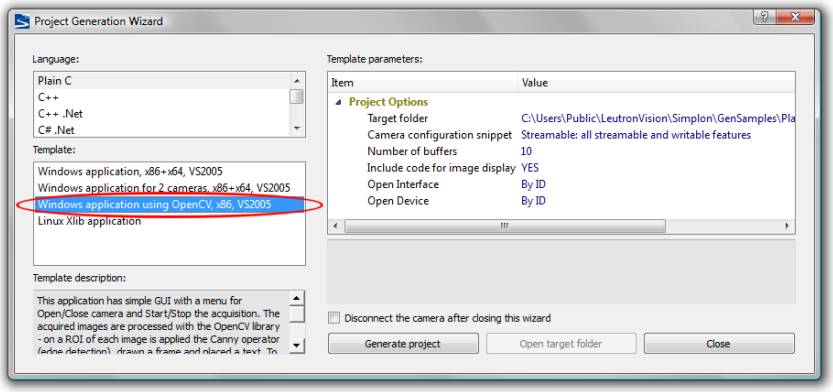



*Figure 8.2. Simplon Explorer — select the OpenCV template in the wizard*

The generated sample is trivial and should be easy to follow. It passes the acquired data to the OpenCV library using its `IplImage` structure. This approach allows to keep the full flexibility of the Simplon API interface while programming with OpenCV.

*The OpenCV library can be used also on our PicSight-Smart architecture.*

# 9. Troubleshooting & Support

## 9.1. Getting support for Leutron Vision products

### 9.1.1. Before you contact the support team

To get the most effective support for your problems, please make sure that you

- Check if your issue does not belong to the list of the most common issues (providing solutions to all of them).
- Send the problem report to proper e-mail address, depending on your location and the problem nature, as explained in Section 9.1.2, "Contact options" [p. 288].
- Make sure the problem is well reproducible, preferably with the Simplon Explorer and that you capture the `lv.simplon.log` file (Section 9.1.3, "Gathering information about the problem" [p. 288]).
- Attach the captured log file (one per each session if multiple test scenarios are described in the report) as well as other important information, describe all details about the problem, see Section 9.1.4, "Reporting the problem" [p. 289].

Following these guidelines will guarantee that your problem can be solved effectively, in the shortest possible time.

### 9.1.2. Contact options

Following list should help to identify the e-mail contact to be used for your problem report:

- If you purchased Leutron Vision products through a distributor, please contact that distributor with every support case. The list of Leutron Vision distributors[1] with their contact information is provided in our website.
- If you reside in Germany or Austria, contact <desupport@leutron.com>.
- If you reside in US or Canada, contact <ussupport@leutron.com>.
- If you reside in Czech republic or Slovakia, contact <czsupport@leutron.com>.
- In all other cases contact
  - <gigesupport@picsight.com> for issues related to PicSight-GigE/PicSight-Smart cameras
  - <linuxsupport@leutron.com> for any issues with Simplon for Linux
  - and <intsupport@leutron.com> for any other products, issues and questions

### 9.1.3. Gathering information about the problem

When collecting information about your problem, please follow the steps listed hereafter:

1. **Be sure you use the latest version of Simplon.** It may be that you have an old version of Simplon installed and you are experiencing a bug, which was already removed in the meantime. The version of currently installed Simplon is visible in the Simplon Explorer tool (menu Help → About). The latest Simplon version can be downloaded from the Simplon

[1] http://www.leutron.com/sales-contact/

download area[2]. If you have not registered yet for Simplon download on our website, you will have to do so first.

2. **Enable logging.** Before attempting to reproduce the problem, be sure the logging is enabled through the Simplon Settings tool (or directly the `lv.simplon.ini` file (refer to Section 5.7.1, "Simplon Settings utility and the configuration file" [p. 93]). Enable logging to file, preferably with highest log level. If the application crashes and the log is not complete, switch on the `Disable all buffering` log configuration option.

3. **Test the hardware functionality with a supplied demo program, Simplon Explorer.** As the first step use the "standard" demo program, Simplon Explorer, which covers most of the possibilities of Leutron Vision hardware usage.

   If you are able to reproduce the problem in Simplon Explorer, then the problem is probably not in your code. However, it still need not be a bug, a problem can be also caused by an improper configuration.

4. **Camera configuration.** Check especially whether the camera is set in a proper working mode. See camera documentation to learn how the camera should be adjusted.

5. **Check with another hardware.** Sometimes the problem can be caused by the HW/SW environment or by a defective piece of hardware. If it is in your possibilities, try if the same problem happens on another PC. If you have another camera of the same type available, try if the problem happens also after the camera replacement. For GigE Vision based cameras, review the network configuration and try to connect the camera directly, without additional network components in the path.

6. **Check with your application.** If the problem could not be reproduced in the previous steps, reproduce the problem in your application. If it is possible, extract and send us the smallest part of your code that can demonstrate where the problem occurs. Even better is if you can make the extracted code fragment compilable, so that the problem can be reproduced with a small application that you can send to us. Make sure that your application does proper error handling when accessing Simplon functions. Ignoring the error status of Simplon functions can lead to unexpected behavior of your application.

7. **Screenshots.** In case of disturbances in the acquired images, make and send us the screenshots of them, either as bitmaps with lossless compression (`.bmp`, `.png`) or as `.jpg` with a high quality (small compression).

8. **Send us the report.** Send all the collected information (and especially the `lv.simplon.log` file) to us, following guidelines from Section 9.1.4, "Reporting the problem" [p. 289].

## 9.1.4. Reporting the problem

Each problem report should contain following information:

- The e-mail subject should give a brief but specific description of the problem and your company name (separated by a "@" character). The subject will be used to identify evolution of the support case, so if you need to submit a different problem, create a new subject string, do not reuse the old one.
  - Example of a good subject: *Changing exposure time has no effect @ My Company Inc.*
  - Example of a bad subject: *Problem with camera*
- With each new support case, please list your Simplon registration number in the e-mail.

[2] http://www.leutron.com/support-downloads/download-area/

- Describe your problem in detail, including all its symptoms, conditions under which it occurs and all other information that can help resolving the problem. List all the information you gathered while testing and reproducing the problem, as described in Section 9.1.3, "Gathering information about the problem" [p. 288].
- Attach the required `lv.simplon.log` file (one per each reported session). The file absolutely essential for our support team and failing to attach it will usually only lead to a response asking you to collect and send it, which will in effect make the time needed for the resolution longer. Be sure that you send the log file generated during the problematic session you are mentioning in your report reporting.
- If the problem occurs only under some conditions or only with some particular piece of hardware or software, describe the differences between the two cases and attach log files generated during both the successful and problematic sessions. If only a specific sequence of steps leads to the problem, describe this sequence.

### 9.1.5. Return Material Authorization (RMA)

If you need to return some (possibly defective) material to Leutron Vision, please use the RMA application[3] on our website. The application will query you for some important information about your product(s) and their defect(s), deciding automatically, whether you should send the material immediately back to Leutron Vision (or your distributor) or whether we will first contact you to do more tests for problem verification.

### 9.1.6. Customer registration

Customers willing to get (different level of) access rights to Leutron Vision download area[4] should first register on our website. The registration area[5] provides various registration possibilities from access to freely downloadable data (anyone can get access to it) to access to Simplon download[6] (you need to purchase Simplon first).

## 9.2. Troubleshooting Leutron Vision products

### 9.2.1. Troubleshooting common issues

The lists below mention some most common issues that can be faced by customers, but have easy solution. It is a good idea to check this list first when encountering a problem. It is also a good idea to check Section 9.2.2, "Known problems and limitations" [p. 291] and Section 9.2.3, "Simplon logging" [p. 291] whether some hints can be found there.

- If you are not getting any image, if you get different image data than expected or if you have problems with acquisition timing, check again carefully that the camera is set in proper working mode and that it is not in some error status (see camera manual for possible description of such situations).
- If you have problems with acquisition from a PicSight-GigE/PicSight-Smart camera, check whether your firewall settings do not interfere with the acquisition. PicSight-GigE user manual provides more information about this topic.

[3] http://www.leutron.com/rma/client_id.php
[4] http://www.leutron.com/support-downloads/download-area/
[5] http://www.leutron.com/support-downloads/registrations/
[6] http://www.leutron.com/support-downloads/download-area/

## 9.2.2. Known problems and limitations

### 9.2.2.1. Simplon software package

(none in current version)

### 9.2.2.2. PicSight-GigE/PicSight-Smart cameras

- For the R312AB models, changing the exposure time in triggered mode or in acquisition frame rate control mode may crash the sensor and a reset of the camera is necessary. This can happen if the trigger frequency is near the limitation of the frame time which depends on the exposure time. For example, a trigger frequency of 10 Hz with changing exposure times below 10 ms are not affected. Please ask support for more details and current status.

## 9.2.3. Simplon logging

All the Simplon components are using a common logging subsystem, which can be configured through the `lv.simplon.ini` and Simplon Settings (Section 5.7.1, “Simplon Settings utility and the configuration file” [p. 93]).

The log can be directed to various outputs, while the most important of them (especially for support) is the file output. The log file path can be adjusted, however the default name (`lv.simplon.log`) as well as the default location (application data directory under Windows, `/var/opt/simplon/log` under Linux) will be just right in most situations.

The logging level can also be adjusted. While the default level `Info (4)` provides most useful information about the system and Simplon operation, for specific troubleshooting and support requests, it is often useful to switch to the most verbose level `Trace (6)`.

For the case of troubleshooting problems involving an application crash, when the log might not be written completely (log buffers not flushed completely at the time of application crash), the logging subsystem should be configured to avoid any buffering. In such case, please switch on the `Disable all buffering` option.

The logging configuration offers few more options, the most important of them being the max allowed size of the log file. The log can be also directed to other outputs, but those are mainly intended for use during advanced debugging by qualified personnel.

Several logging mechanisms are used by various Simplon components. They are separated to utilize log analysis, to separate domain-specific info from the general purpose logs and to improve performance, logging only what needs to get logged in a given situation. Creation of these log files can usually be controlled by the user.

*Note however, that all the information in the logs is just informative and its main purpose is to assist the Leutron Vision support team when trying to resolve possible problems. It is not designed as a tool that should be necessarily well understandable by users, it might be misleading and all the information is context-specific. If a word “error” or “warning” appears in the log, it does not necessarily mean a real error occurred, it might be valid situation in a given context. You don't need to get alarmed because of that and contact support, especially if the application is otherwise working well.*

## 9.2.4. Debugging with GigE Vision cameras

When debugging an application using GigE Vision cameras (PicSight-GigE/PicSight-Smart), it's necessary to pay attention to a low level GigE Vision communication parameter, the heartbeat timeout.

This timeout, in milliseconds, defines how frequently has the camera send the “heartbeat” messages to the camera, indicating that it's still alive. When the camera does not receive the message within the specified timeout period, it assumes the application has gone away and disconnects itself. The default value used in Simplon is 3 s (other software packages might use another value).

At most times, the heartbeat handling is fully transparent to the user. However, during debugging, when a developer stops the application at a breakpoint for single stepping, the Simplon heartbeat handling thread would also stop, fail to deliver the heartbeat messages and the camera would disconnect. To prevent that, we recommend to increase the heartbeat timeout parameter to a higher value. The exact value should be a compromise between being able to debug comfortably, while understanding that when the application stops unexpectedly without disconnecting the camera properly, it will take a while before the camera disconnects automatically and becomes available for another connection.

The parameter is configurable through camera features at runtime (the feature's GenICam name is `GevHeartbeatTimeout`), while its default value can be adjusted through the Simplon Settings utility, configuration option `Heartbeat timeout`.

Note that some software packages attempt to increase the timeout automatically, whenever they find out that a debugger is attached to the process. We don't do that since we believe that the correct heartbeat timeout value can only be determined by the application developer, for reasons described above.

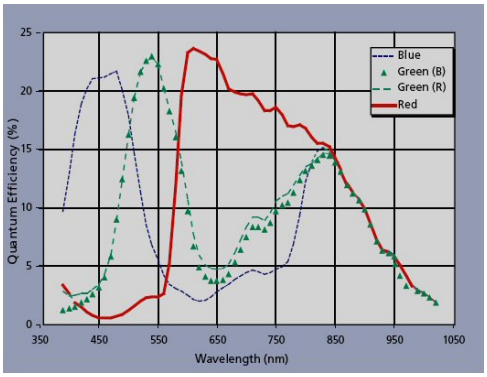
## 9.2.5. Debugging symbols

When debugging certain kinds of problems, such as application crash, it might be very useful if you can provide the support team with extended diagnostic information, such as the stack trace showing the crash point. The installer of Simplon for Windows allows to install “PDB files” — files containing the debugging information (symbols) for the Simplon libraries. We recommend to install these debug files on the development and testing systems, so that it is possible to generate the stack trace info whenever encountering a problem. The files are located in the `bin\Debug` subdirectory of the Simplon installation.

Note that in Linux version of Simplon the symbols are directly included in the libraries and executables.

# Appendix A. Technical specifications for individual models

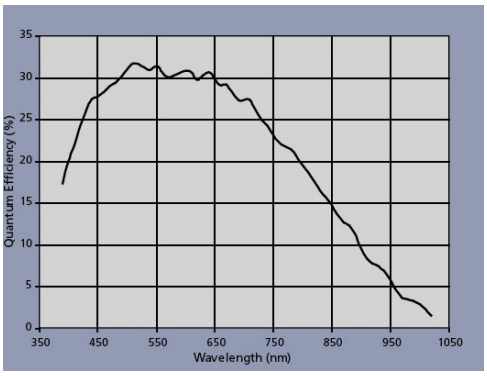
## A.1. PicSight G32B-GigE-AS

| Specification | PicSight G32B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CMOS, parallel readout, type Aptina MT9V403 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 656 × 492 pixels |
| Frame rate | 196 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 9.9 × 9.9 µm |
| Sensor size (H×V) | 6.5241 × 4.8906 mm |
| Shutter | global, 20 µs –1300 ms (default 5 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |
| Gain & black level | • Analog gain: 0 .. 23.52 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: -1.5 .. 1.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 46 dB |
| Dynamic range | 53 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |

| Specification | PicSight G32B-GigE-AS |
|---|---|
| Power input | 10-26V/5W |
| Ordering information | • 401202: PicSight G32B-GigE-AS (Hirose/SDR-26 connector)<br>• 401203: PicSight G32B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 401227: PicSight G32B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 401228: PicSight G32B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 401302: PicSight G32B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 401303: PicSight G32B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 401327: PicSight G32B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 401328: PicSight G32B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.1. PicSight G32B-GigE-AS technical specifications*

# A.2. PicSight G32M-GigE-AS

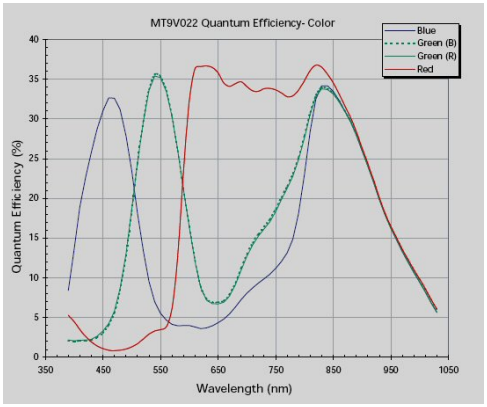
| Specification | PicSight G32M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CMOS, parallel readout, type Aptina MT9V403 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 656 × 492 pixels |
| Frame rate | 196 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 9.9 × 9.9 µm |
| Sensor size (H×V) | 6.5241 × 4.8906 mm |
| Shutter | global, 20 µs –1300 ms (default 5 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |

| Specification | PicSight G32M-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: 0 .. 23.52 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: -1.5 .. 1.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 46 dB |
| Dynamic range | 53 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 400202: PicSight G32M-GigE-AS (Hirose/SDR-26 connector)<br>• 400203: PicSight G32M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 400227: PicSight G32M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 400228: PicSight G32M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 400302: PicSight G32M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 400303: PicSight G32M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 400327: PicSight G32M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 400328: PicSight G32M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.2. PicSight G32M-GigE-AS technical specifications*

# A.3. PicSight G43AB-GigE-AS

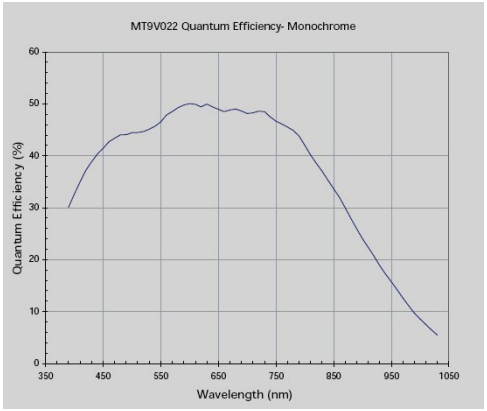
| Specification | PicSight G43AB-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/3" CMOS, parallel readout, type Aptina MT9V033 |

| **Specification** | **PicSight G43AB-GigE-AS** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 752 × 480 pixels |
| Frame rate | 62 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 6 × 6 µm |
| Sensor size (H×V) | 4.512 × 2.88 mm |
| Shutter | global, 10 µs –1000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |
| Gain & black level | • Analog gain: 0 .. 12.04 dB (default 12 dB)<br>• Digital gain: -12.04 .. 11.48 dB (default 0 dB)<br>• Black level: 0 .. 6.35 DN (default 0 DN) |
| Auto functions | • Auto exposure<br>• Automatic analog gain control<br>• Automatic black level |
| Signal/noise ratio | 42 dB |
| Dynamic range | 49 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight G43AB-GigE-AS |
|---|---|
| Ordering information | • 413202: PicSight G43AB-GigE-AS (Hirose/SDR-26 connector)<br>• 413203: PicSight G43AB-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 413227: PicSight G43AB-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 413228: PicSight G43AB-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 413302: PicSight G43AB-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 413303: PicSight G43AB-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 413327: PicSight G43AB-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 413328: PicSight G43AB-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.3. PicSight G43AB-GigE-AS technical specifications*

# A.4. PicSight G43AM-GigE-AS

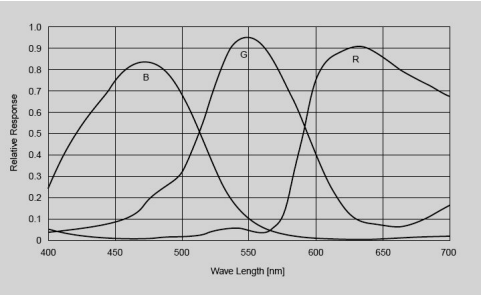
| Specification | PicSight G43AM-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/3" CMOS, parallel readout, type Aptina MT9V033 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 752 × 480 pixels |
| Frame rate | 62 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 6 × 6 µm |
| Sensor size (H×V) | 4.512 × 2.88 mm |
| Shutter | global, 10 µs –1000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |

| Specification | PicSight G43AM-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: 0 .. 12.04 dB (default 4 dB)<br>• Digital gain: -12.04 .. 11.48 dB (default 0 dB)<br>• Black level: 0 .. 6.35 DN (default 0 DN) |
| Auto functions | • Auto exposure<br>• Automatic analog gain control<br>• Automatic black level |
| Signal/noise ratio | 42 dB |
| Dynamic range | 49 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | • Horizontal: 2× 4×<br>• Vertical: 2× 4× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 412202: PicSight G43AM-GigE-AS (Hirose/SDR-26 connector)<br>• 412203: PicSight G43AM-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 412227: PicSight G43AM-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 412228: PicSight G43AM-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 412302: PicSight G43AM-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 412303: PicSight G43AM-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 412327: PicSight G43AM-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 412328: PicSight G43AM-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.4. PicSight G43AM-GigE-AS technical specifications*

# A.5. PicSight P133B-GigE-AS

| Specification | PicSight P133B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/1" CCD, interline transfer, type SONY ICX442AQ |

| **Specification** | **PicSight P133B-GigE-AS** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1304 × 976 pixels |
| Full sensor resolution (incl. black pixels) | 1360 × 986 pixels |
| Frame rate | 8.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 0 × 0 µm |
| Sensor size (H×V) | 6.23 × 5.09 mm |
| Shutter | global, 5 µs –60000 ms (default 100 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -10 .. 26 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

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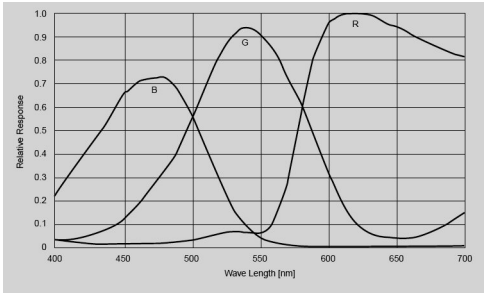
| Specification | PicSight P133B-GigE-AS |
|---|---|
| Ordering information | • 151202: PicSight P133B-GigE-AS (Hirose/SDR-26 connector)<br>• 151203: PicSight P133B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 151227: PicSight P133B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 151228: PicSight P133B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 151302: PicSight P133B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 151303: PicSight P133B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 151327: PicSight P133B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 151328: PicSight P133B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.5. PicSight P133B-GigE-AS technical specifications*

# A.6. PicSight P141B-GigE-AS

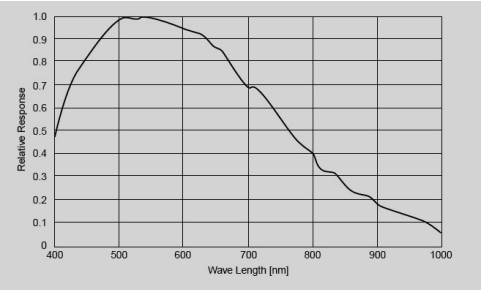
| Specification | PicSight P141B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 2/3" CCD, interline transfer, type SONY ICX285 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1392 × 1040 pixels |
| Full sensor resolution (incl. black pixels) | 1438 × 1050 pixels |
| Frame rate | 20.2 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 6.45 × 6.45 µm |
| Sensor size (H×V) | 10.2 × 8.3 mm |
| Shutter | global, 5 µs –60000 ms (default 48 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P141B-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: -3 .. 33 dB (default 9 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 181202: PicSight P141B-GigE-AS (Hirose/SDR-26 connector)<br>• 181203: PicSight P141B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 181227: PicSight P141B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 181228: PicSight P141B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 181302: PicSight P141B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 181303: PicSight P141B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 181327: PicSight P141B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 181328: PicSight P141B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.6. PicSight P141B-GigE-AS technical specifications*

# A.7. PicSight P141M-GigE-AS

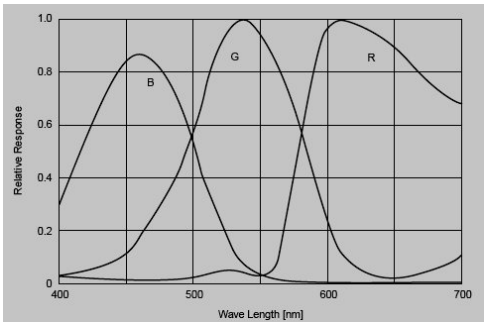
| Specification | PicSight P141M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 2/3" CCD, interline transfer, type SONY ICX285 |

| Specification | PicSight P141M-GigE-AS |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 1392 × 1040 pixels |
| Full sensor resolution (incl. black pixels) | 1438 × 1050 pixels |
| Frame rate | 20.2 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 6.45 × 6.45 µm |
| Sensor size (H×V) | 10.2 × 8.3 mm |
| Shutter | global, 5 µs –60000 ms (default 48 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -3 .. 33 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 43 dB |
| Dynamic range | 77 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P141M-GigE-AS |
|---|---|
| Ordering information | • 180202: PicSight P141M-GigE-AS (Hirose/SDR-26 connector)<br>• 180203: PicSight P141M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 180227: PicSight P141M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 180228: PicSight P141M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 180302: PicSight P141M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 180303: PicSight P141M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 180327: PicSight P141M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 180328: PicSight P141M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.7. PicSight P141M-GigE-AS technical specifications*

# A.8. PicSight P142AB-GigE-AS

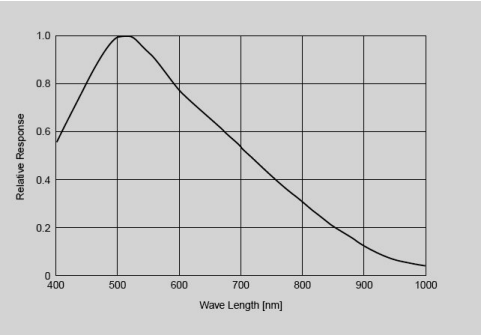
| Specification | PicSight P142AB-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX267 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1392 × 1040 pixels |
| Full sensor resolution (incl. black pixels) | 1434 × 1050 pixels |
| Frame rate | 0.15 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.65 × 4.65 µm |
| Sensor size (H×V) | 7.6 × 6.2 mm |
| Shutter | global, 5 µs –60000 ms (default 130 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P142AB-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: -8 .. 28 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 171202: PicSight P142AB-GigE-AS (Hirose/SDR-26 connector)<br>• 171203: PicSight P142AB-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 171227: PicSight P142AB-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 171228: PicSight P142AB-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 171302: PicSight P142AB-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 171303: PicSight P142AB-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 171327: PicSight P142AB-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 171328: PicSight P142AB-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.8. PicSight P142AB-GigE-AS technical specifications*

# A.9. PicSight P142AM-GigE-AS

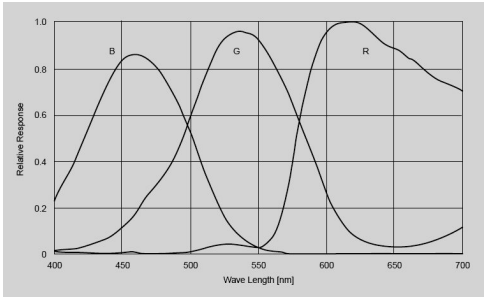
| Specification | PicSight P142AM-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX267 |

| Specification | PicSight P142AM-GigE-AS |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 1392 × 1040 pixels |
| Full sensor resolution (incl. black pixels) | 1434 × 1050 pixels |
| Frame rate | 0.15 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.65 × 4.65 µm |
| Sensor size (H×V) | 7.6 × 6.2 mm |
| Shutter | global, 5 µs –60000 ms (default 50 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -8 .. 28 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 43 dB |
| Dynamic range | 71 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P142AM-GigE-AS |
|---|---|
| Ordering information | • 170202: PicSight P142AM-GigE-AS (Hirose/SDR-26 connector)<br>• 170203: PicSight P142AM-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 170227: PicSight P142AM-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 170228: PicSight P142AM-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 170302: PicSight P142AM-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 170303: PicSight P142AM-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 170327: PicSight P142AM-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 170328: PicSight P142AM-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.9. PicSight P142AM-GigE-AS technical specifications*

# A.10. PicSight P202B-GigE-AS

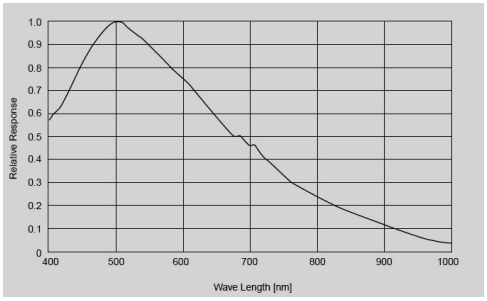
| Specification | PicSight P202B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/1.8" CCD, interline transfer, type SONY ICX274 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1624 × 1236 pixels |
| Full sensor resolution (incl. black pixels) | 1688 × 1248 pixels |
| Frame rate | 14.6 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.4 × 4.4 µm |
| Sensor size (H×V) | 8.5 × 6.8 mm |
| Shutter | global, 5 µs –60000 ms (default 60 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P202B-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: -10 .. 26 dB (default 4 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 211202: PicSight P202B-GigE-AS (Hirose/SDR-26 connector)<br>• 211203: PicSight P202B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 211227: PicSight P202B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 211228: PicSight P202B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 211302: PicSight P202B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 211303: PicSight P202B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 211327: PicSight P202B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 211328: PicSight P202B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.10. PicSight P202B-GigE-AS technical specifications*

# A.11. PicSight P202M-GigE-AS

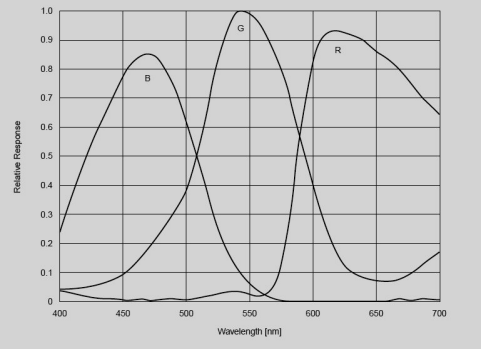
| Specification | PicSight P202M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/1.8" CCD, interline transfer, type SONY ICX274 |

| Specification | PicSight P202M-GigE-AS |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 1624 × 1236 pixels |
| Full sensor resolution (incl. black pixels) | 1688 × 1248 pixels |
| Frame rate | 14.6 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.4 × 4.4 µm |
| Sensor size (H×V) | 8.5 × 6.8 mm |
| Shutter | global, 5 µs –60000 ms (default 30 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -10 .. 26 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 40 dB |
| Dynamic range | 69 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P202M-GigE-AS |
|---|---|
| Ordering information | • 210202: PicSight P202M-GigE-AS (Hirose/SDR-26 connector)<br>• 210203: PicSight P202M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 210227: PicSight P202M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 210228: PicSight P202M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 210302: PicSight P202M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 210303: PicSight P202M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 210327: PicSight P202M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 210328: PicSight P202M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.11. PicSight P202M-GigE-AS technical specifications*

# A.12. PicSight P203B-GigE-AS

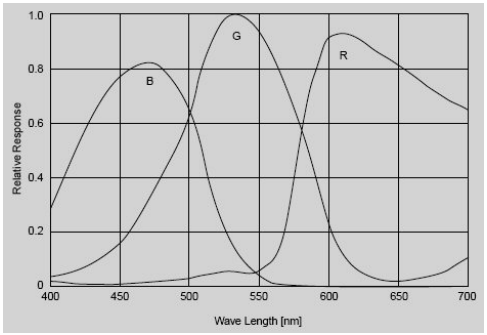
| Specification | PicSight P203B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/1" CCD, interline transfer, type SONY ICX454JQF-J |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1648 × 1240 pixels |
| Full sensor resolution (incl. black pixels) | 1690 × 1250 pixels |
| Frame rate | 9.2 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 0 × 0 µm |
| Sensor size (H×V) | 6.38 × 5.26 mm |
| Shutter | global, 5 µs –60000 ms (default 100 ms) |

| Specification | PicSight P203B-GigE-AS |
|---|---|
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -6 .. 26 dB (default 6 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 201202: PicSight P203B-GigE-AS (Hirose/SDR-26 connector)<br>• 201203: PicSight P203B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 201227: PicSight P203B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 201228: PicSight P203B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 201302: PicSight P203B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 201303: PicSight P203B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 201327: PicSight P203B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 201328: PicSight P203B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.12. PicSight P203B-GigE-AS technical specifications*

# A.13. PicSight P32B-GigE-AS

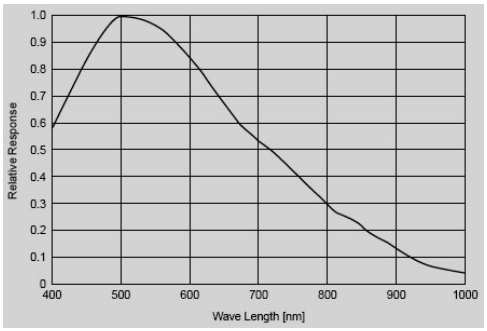
| Specification | PicSight P32B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX414 |

| Specification | PicSight P32B-GigE-AS |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 9.9 × 9.9 µm |
| Sensor size (H×V) | 7.48 × 6.15 mm |
| Shutter | global, 5 µs –60000 ms (default 16 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -6 .. 30 dB (default 10 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P32B-GigE-AS |
|---|---|
| Ordering information | • 121202: PicSight P32B-GigE-AS (Hirose/SDR-26 connector)<br>• 121203: PicSight P32B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 121227: PicSight P32B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 121228: PicSight P32B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 121302: PicSight P32B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 121303: PicSight P32B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 121327: PicSight P32B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 121328: PicSight P32B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.13. PicSight P32B-GigE-AS technical specifications*

# A.14. PicSight P32M-GigE-AS

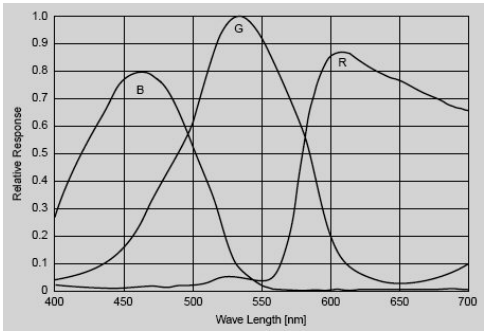
| Specification | PicSight P32M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX414 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 9.9 × 9.9 µm |
| Sensor size (H×V) | 7.48 × 6.15 mm |
| Shutter | global, 5 µs –60000 ms (default 16 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P32M-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: -6 .. 30 dB (default 4 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 45 dB |
| Dynamic range | 73 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 120202: PicSight P32M-GigE-AS (Hirose/SDR-26 connector)<br>• 120203: PicSight P32M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 120227: PicSight P32M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 120228: PicSight P32M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 120302: PicSight P32M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 120303: PicSight P32M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 120327: PicSight P32M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 120328: PicSight P32M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.14. PicSight P32M-GigE-AS technical specifications*

# A.15. PicSight P33B-GigE-AS

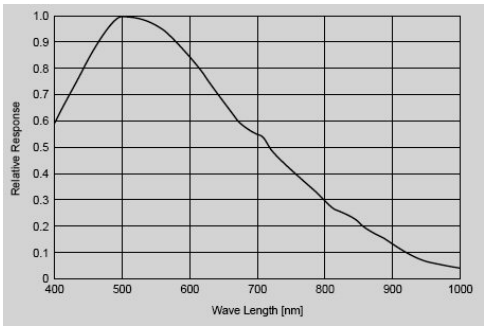
| Specification | PicSight P33B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/3" CCD, interline transfer, type SONY ICX424 |

| Specification | PicSight P33B-GigE-AS |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 7.4 × 7.4 µm |
| Sensor size (H×V) | 5.79 × 4.89 mm |
| Shutter | global, 5 µs –60000 ms (default 16 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -6 .. 30 dB (default 12 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P33B-GigE-AS |
|---|---|
| Ordering information | • 111202: PicSight P33B-GigE-AS (Hirose/SDR-26 connector)<br>• 111203: PicSight P33B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 111227: PicSight P33B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 111228: PicSight P33B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 111302: PicSight P33B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 111303: PicSight P33B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 111327: PicSight P33B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 111328: PicSight P33B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.15. PicSight P33B-GigE-AS technical specifications*

# A.16. PicSight P33M-GigE-AS

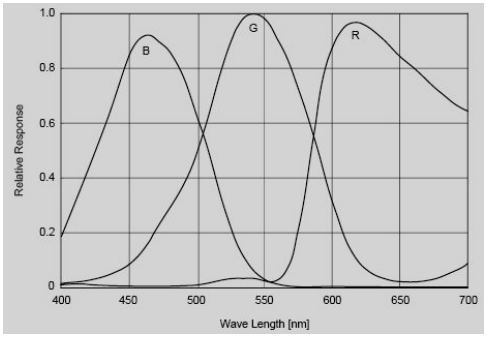
| Specification | PicSight P33M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/3" CCD, interline transfer, type SONY ICX424 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 7.4 × 7.4 µm |
| Sensor size (H×V) | 5.79 × 4.89 mm |
| Shutter | global, 5 µs –60000 ms (default 16 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P33M-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: -6 .. 30 dB (default 4 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 40 dB |
| Dynamic range | 63 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 110202: PicSight P33M-GigE-AS (Hirose/SDR-26 connector)<br>• 110203: PicSight P33M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 110227: PicSight P33M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 110228: PicSight P33M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 110302: PicSight P33M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 110303: PicSight P33M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 110327: PicSight P33M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 110328: PicSight P33M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.16. PicSight P33M-GigE-AS technical specifications*

# A.17. PicSight P34B-GigE-AS

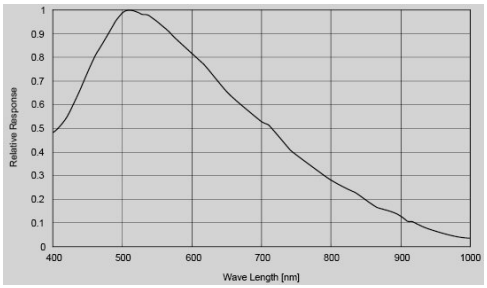
| Specification | PicSight P34B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/4" CCD, interline transfer, type SONY ICX098 |

| Specification | PicSight P34B-GigE-AS |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 64.7 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 5.6 × 5.6 µm |
| Sensor size (H×V) | 4.6 × 3.97 mm |
| Shutter | global, 5 µs –60000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -6 .. 30 dB (default 16 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P34B-GigE-AS |
|---|---|
| Ordering information | • 101202: PicSight P34B-GigE-AS (Hirose/SDR-26 connector)<br>• 101203: PicSight P34B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 101227: PicSight P34B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 101228: PicSight P34B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 101302: PicSight P34B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 101303: PicSight P34B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 101327: PicSight P34B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 101328: PicSight P34B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.17. PicSight P34B-GigE-AS technical specifications*

# A.18. PicSight P34M-GigE-AS

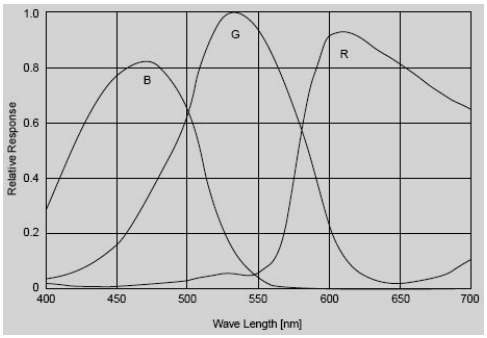
| Specification | PicSight P34M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/4" CCD, interline transfer, type SONY ICX098 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 64.7 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 5.6 × 5.6 µm |
| Sensor size (H×V) | 4.6 × 3.97 mm |
| Shutter | global, 5 µs –60000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P34M-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: -6 .. 30 dB (default 9 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 44 dB |
| Dynamic range | 69 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 100202: PicSight P34M-GigE-AS (Hirose/SDR-26 connector)<br>• 100203: PicSight P34M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 100227: PicSight P34M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 100228: PicSight P34M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 100302: PicSight P34M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 100303: PicSight P34M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 100327: PicSight P34M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 100328: PicSight P34M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.18. PicSight P34M-GigE-AS technical specifications*

# A.19. PicSight P52B-GigE-AS

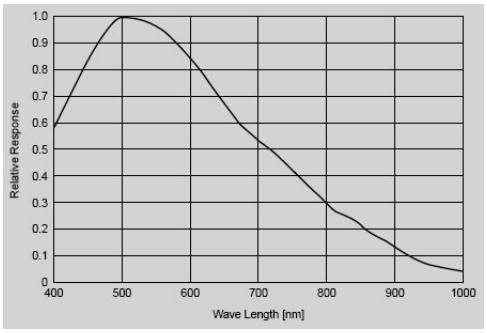
| Specification | PicSight P52B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX415 |

| Specification | PicSight P52B-GigE-AS |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 776 × 580 pixels |
| Full sensor resolution (incl. black pixels) | 823 × 592 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 8.3 × 8.3 µm |
| Sensor size (H×V) | 7.48 × 6.15 mm |
| Shutter | global, 5 µs –60000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -10 .. 26 dB (default 12 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P52B-GigE-AS |
|---|---|
| Ordering information | • 131202: PicSight P52B-GigE-AS (Hirose/SDR-26 connector)<br>• 131203: PicSight P52B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 131227: PicSight P52B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 131228: PicSight P52B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 131302: PicSight P52B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 131303: PicSight P52B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 131327: PicSight P52B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 131328: PicSight P52B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.19. PicSight P52B-GigE-AS technical specifications*

# A.20. PicSight P52M-GigE-AS

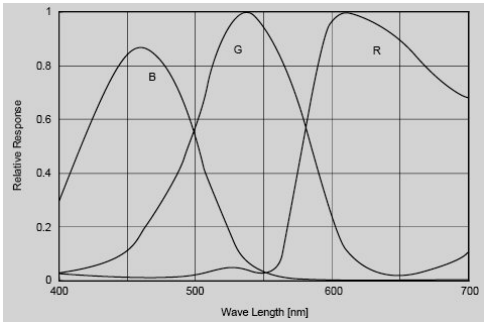
| Specification | PicSight P52M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX415 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 776 × 580 pixels |
| Full sensor resolution (incl. black pixels) | 823 × 592 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 8.3 × 8.3 µm |
| Sensor size (H×V) | 7.48 × 6.15 mm |
| Shutter | global, 5 µs –60000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P52M-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: -10 .. 26 dB (default 4 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 44 dB |
| Dynamic range | 69 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 130202: PicSight P52M-GigE-AS (Hirose/SDR-26 connector)<br>• 130203: PicSight P52M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 130227: PicSight P52M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 130228: PicSight P52M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 130302: PicSight P52M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 130303: PicSight P52M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 130327: PicSight P52M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 130328: PicSight P52M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.20. PicSight P52M-GigE-AS technical specifications*

# A.21. PicSight P83B-GigE-AS

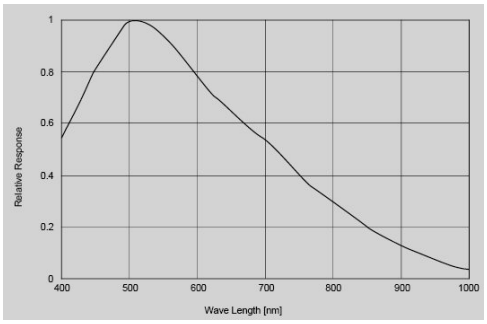
| Specification | PicSight P83B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/3" CCD, interline transfer, type SONY ICX204 |

| **Specification** | **PicSight P83B-GigE-AS** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1032 × 776 pixels |
| Full sensor resolution (incl. black pixels) | 1077 × 788 pixels |
| Frame rate | 32.5 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.65 × 4.65 µm |
| Sensor size (H×V) | 5.8 × 4.92 mm |
| Shutter | global, 5 µs –60000 ms (default 30 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -8 .. 28 dB (default 16 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P83B-GigE-AS |
|---|---|
| Ordering information | • 141202: PicSight P83B-GigE-AS (Hirose/SDR-26 connector)<br>• 141203: PicSight P83B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 141227: PicSight P83B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 141228: PicSight P83B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 141302: PicSight P83B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 141303: PicSight P83B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 141327: PicSight P83B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 141328: PicSight P83B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.21. PicSight P83B-GigE-AS technical specifications*

# A.22. PicSight P83M-GigE-AS

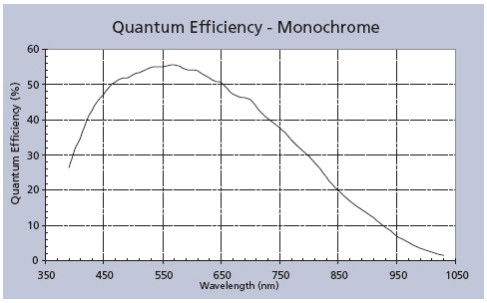
| Specification | PicSight P83M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/3" CCD, interline transfer, type SONY ICX204 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 1032 × 776 pixels |
| Full sensor resolution (incl. black pixels) | 1077 × 788 pixels |
| Frame rate | 32.5 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.65 × 4.65 µm |
| Sensor size (H×V) | 5.8 × 4.92 mm |
| Shutter | global, 5 µs –60000 ms (default 30 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P83M-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: -8 .. 28 dB (default 14 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 42 dB |
| Dynamic range | 73 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 140202: PicSight P83M-GigE-AS (Hirose/SDR-26 connector)<br>• 140203: PicSight P83M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 140227: PicSight P83M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 140228: PicSight P83M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 140302: PicSight P83M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 140303: PicSight P83M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 140327: PicSight P83M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 140328: PicSight P83M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.22. PicSight P83M-GigE-AS technical specifications*

# A.23. PicSight R132M-GigE-AS

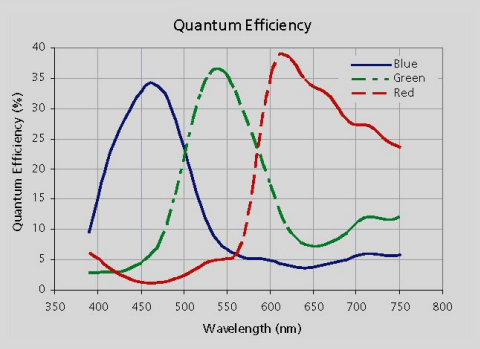
| Specification | PicSight R132M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CMOS, sequential readout, type Aptina MT9M001 |

| **Specification** | **PicSight R132M-GigE-AS** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | monochrom |
| Output image resolution (H×V) | 1280 × 1024 pixels |
| Frame rate | 30 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 5.2 × 5.2 µm |
| Sensor size (H×V) | 6.66 × 5.32 mm |
| Shutter | rolling, 28 µs –520 ms (default 30 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |
| Gain & black level | • Analog gain: 0 .. 23.53 dB (default 14 dB)<br>• Digital gain: n/a<br>• Black level: -51.2 .. 51 DN (default 0 DN) |
| Auto functions | • Automatic black level |
| Signal/noise ratio | 42 dB |
| Dynamic range | 52 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | • Horizontal: 2× 4× 8×<br>• Vertical: 2× 4× 8× |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight R132M-GigE-AS |
|---|---|
| Ordering information | • 420202: PicSight R132M-GigE-AS (Hirose/SDR-26 connector)<br>• 420203: PicSight R132M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 420227: PicSight R132M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 420228: PicSight R132M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 420302: PicSight R132M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 420303: PicSight R132M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 420327: PicSight R132M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 420328: PicSight R132M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.23. PicSight R132M-GigE-AS technical specifications*

# A.24. PicSight R312AB-GigE-AS

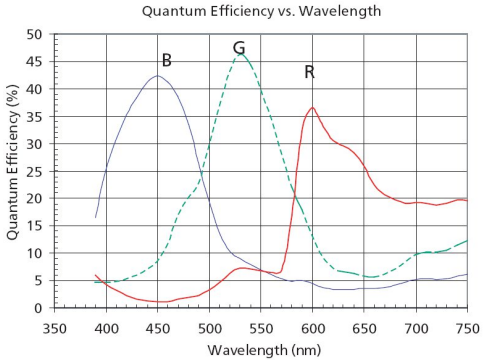
| Specification | PicSight R312AB-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2" CMOS, sequential readout, type Aptina MT9T001 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 2048 × 1536 pixels |
| Frame rate | 12.77 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 3.2 × 3.2 µm |
| Sensor size (H×V) | 6.5536 × 4.9152 mm |
| Shutter | rolling, 47 µs –520 ms (default 10 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |

| Specification | PicSight R312AB-GigE-AS |
|---|---|
| Gain & black level | • Analog gain: 0 .. 18.07 dB (default 18 dB)<br>• Digital gain: 0 .. 24.08 dB (default 0 dB)<br>• Black level: -51.2 .. 51 DN (default 0 DN) |
| Auto functions | • Automatic black level |
| Signal/noise ratio | 43 dB |
| Dynamic range | 61 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | • Horizontal: 2× 3×<br>• Vertical: 2× 3× |
| Decimation | • Horizontal: 2× 3× 4× 8×<br>• Vertical: 2× 3× 4× 8× |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 441202: PicSight R312AB-GigE-AS (Hirose/SDR-26 connector)<br>• 441203: PicSight R312AB-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 441227: PicSight R312AB-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 441228: PicSight R312AB-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 441302: PicSight R312AB-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 441303: PicSight R312AB-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 441327: PicSight R312AB-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 441328: PicSight R312AB-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.24. PicSight R312AB-GigE-AS technical specifications*

# A.25. PicSight R502B-GigE-AS

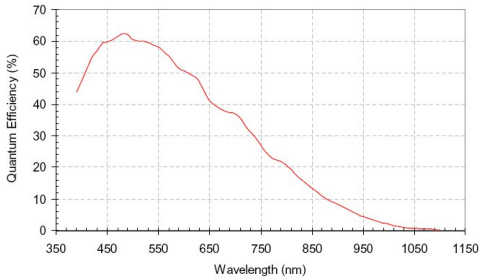
| Specification | PicSight R502B-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2.5" CMOS, sequential readout, type Aptina MT9P031 |

| Specification | PicSight R502B-GigE-AS |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 2592 × 1944 pixels |
| Frame rate | 11.7 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 2.2 × 2.2 µm |
| Sensor size (H×V) | 5.702 × 4.277 mm |
| Shutter | rolling, 39 µs –55000 ms (default 10 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Global reset mode |
| Gain & black level | • Analog gain: 0 .. 18.06 dB (default 0 dB)<br>• Digital gain: 0 .. 24.08 dB (default 0 dB)<br>• Black level: 0 .. 2.55 DN (default 0 DN) |
| Auto functions | • Automatic black level |
| Signal/noise ratio | 38 dB |
| Dynamic range | 70 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | • Horizontal: 2× 4×<br>• Vertical: 2× 4× |
| Decimation | • Horizontal: 2× 3× 4× 5× 6× 7×<br>• Vertical: 2× 3× 4× 5× 6× 7× 8× |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight R502B-GigE-AS |
|---|---|
| Ordering information | • 451202: PicSight R502B-GigE-AS (Hirose/SDR-26 connector)<br>• 451203: PicSight R502B-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 451227: PicSight R502B-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 451228: PicSight R502B-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 451302: PicSight R502B-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 451303: PicSight R502B-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 451327: PicSight R502B-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 451328: PicSight R502B-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.25. PicSight R502B-GigE-AS technical specifications*

# A.26. PicSight R502M-GigE-AS

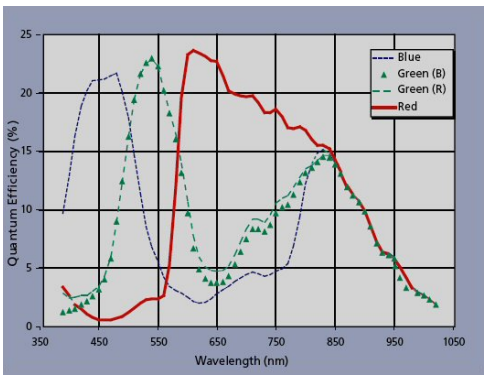
| Specification | PicSight R502M-GigE-AS |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Sensor | 1/2.5" CMOS, sequential readout, type Aptina MT9P031 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 2592 × 1944 pixels |
| Frame rate | 11.7 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 2.2 × 2.2 µm |
| Sensor size (H×V) | 5.702 × 4.277 mm |
| Shutter | rolling, 39 µs –55000 ms (default 10 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Global reset mode |
| Gain & black level | • Analog gain: 0 .. 18.06 dB (default 0 dB)<br>• Digital gain: 0 .. 24.08 dB (default 0 dB)<br>• Black level: 0 .. 2.55 DN (default 0 DN) |

| Specification | PicSight R502M-GigE-AS |
|---|---|
| Auto functions | • Automatic black level |
| Signal/noise ratio | 38 dB |
| Dynamic range | 70 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | • Horizontal: 2× 4×<br>• Vertical: 2× 4× |
| Decimation | • Horizontal: 2× 3× 4× 5× 6× 7×<br>• Vertical: 2× 3× 4× 5× 6× 7× 8× |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 450202: PicSight R502M-GigE-AS (Hirose/SDR-26 connector)<br>• 450203: PicSight R502M-GigE-AS-H (Hirose/SDR-26 connector, 90° lens mount)<br>• 450227: PicSight R502M-GigE-PoE-S (PoE, Hirose/SDR-26 connector)<br>• 450228: PicSight R502M-GigE-PoE-S-H (PoE, Hirose/SDR-26 connector, 90° lens mount)<br>• 450302: PicSight R502M-GigE-AS-RTF (Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 450303: PicSight R502M-GigE-AS-RTF-H (Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 450327: PicSight R502M-GigE-PoE-S-RTF (PoE, Realtime function, lens controller, Hirose/SDR-26 connector)<br>• 450328: PicSight R502M-GigE-PoE-S-RTF-H (PoE, Realtime function, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table A.26. PicSight R502M-GigE-AS technical specifications*

# Appendix B. Technical specifications for the “smart” models

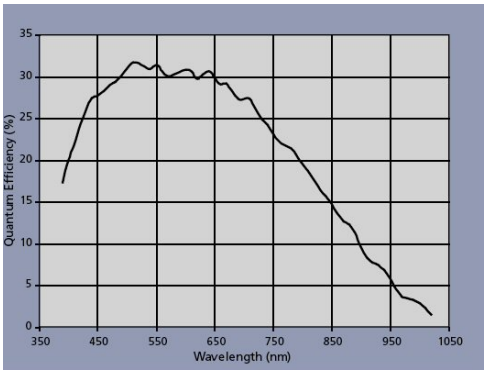
## B.1. PicSight G32B-Smart502

| Specification | PicSight G32B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CMOS, parallel readout, type Aptina MT9V403 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 656 × 492 pixels |
| Frame rate | 196 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 9.9 × 9.9 µm |
| Sensor size (H×V) | 6.5241 × 4.8906 mm |
| Shutter | global, 20 µs –1300 ms (default 5 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |
| Gain & black level | • Analog gain: 0 .. 23.52 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: -1.5 .. 1.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 46 dB |
| Dynamic range | 53 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |

| Specification | PicSight G32B-Smart502 |
|---|---|
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 401602: PicSight G32B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 401603: PicSight G32B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 401627: PicSight G32B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 401628: PicSight G32B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.1. PicSight G32B-Smart502 technical specifications*

# B.2. PicSight G32M-Smart502

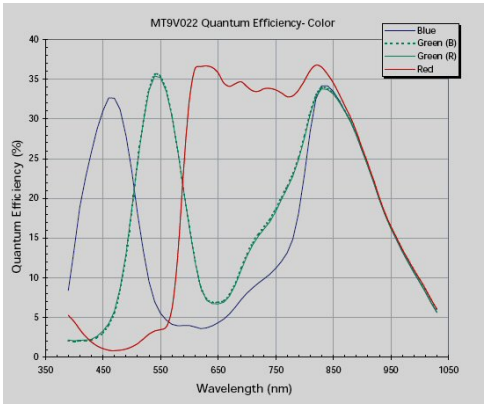
| Specification | PicSight G32M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CMOS, parallel readout, type Aptina MT9V403 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 656 × 492 pixels |
| Frame rate | 196 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 9.9 × 9.9 µm |
| Sensor size (H×V) | 6.5241 × 4.8906 mm |

| Specification | PicSight G32M-Smart502 |
|---|---|
| Shutter | global, 20 µs –1300 ms (default 5 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |
| Gain & black level | • Analog gain: 0 .. 23.52 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: -1.5 .. 1.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 46 dB |
| Dynamic range | 53 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 400602: PicSight G32M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 400603: PicSight G32M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 400627: PicSight G32M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 400628: PicSight G32M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.2. PicSight G32M-Smart502 technical specifications*

# B.3. PicSight G43AB-Smart502

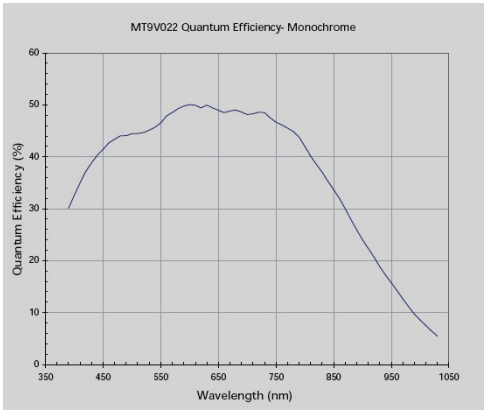
| Specification | PicSight G43AB-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/3" CMOS, parallel readout, type Aptina MT9V033 |

| **Specification** | **PicSight G43AB-Smart502** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 752 × 480 pixels |
| Frame rate | 62 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 6 × 6 µm |
| Sensor size (H×V) | 4.512 × 2.88 mm |
| Shutter | global, 10 µs –1000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |
| Gain & black level | • Analog gain: 0 .. 12.04 dB (default 12 dB)<br>• Digital gain: -12.04 .. 11.48 dB (default 0 dB)<br>• Black level: 0 .. 6.35 DN (default 0 DN) |
| Auto functions | • Auto exposure<br>• Automatic analog gain control<br>• Automatic black level |
| Signal/noise ratio | 42 dB |
| Dynamic range | 49 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight G43AB-Smart502 |
|---|---|
| Ordering information | • 413602: PicSight G43AB-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 413603: PicSight G43AB-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 413627: PicSight G43AB-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 413628: PicSight G43AB-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.3. PicSight G43AB-Smart502 technical specifications*

# B.4. PicSight G43AM-Smart502

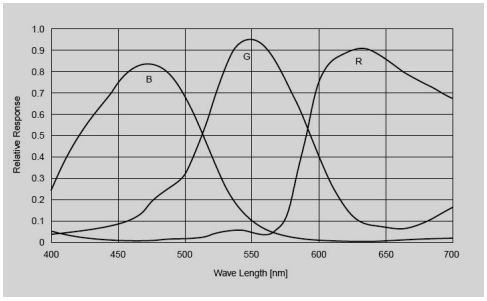
| Specification | PicSight G43AM-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/3" CMOS, parallel readout, type Aptina MT9V033 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 752 × 480 pixels |
| Frame rate | 62 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 6 × 6 µm |
| Sensor size (H×V) | 4.512 × 2.88 mm |
| Shutter | global, 10 µs –1000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |

| Specification | PicSight G43AM-Smart502 |
|---|---|
| Gain & black level | • Analog gain: 0 .. 12.04 dB (default 4 dB)<br>• Digital gain: -12.04 .. 11.48 dB (default 0 dB)<br>• Black level: 0 .. 6.35 DN (default 0 DN) |
| Auto functions | • Auto exposure<br>• Automatic analog gain control<br>• Automatic black level |
| Signal/noise ratio | 42 dB |
| Dynamic range | 49 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | • Horizontal: 2× 4×<br>• Vertical: 2× 4× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 412602: PicSight G43AM-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 412603: PicSight G43AM-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 412627: PicSight G43AM-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 412628: PicSight G43AM-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.4. PicSight G43AM-Smart502 technical specifications*

# B.5. PicSight P133B-Smart502

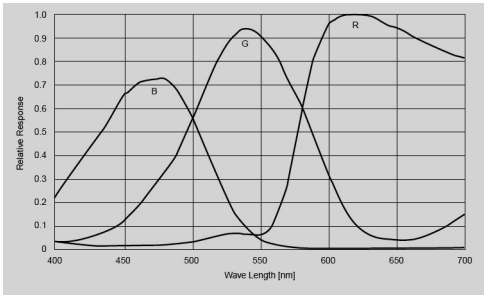
| Specification | PicSight P133B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/1" CCD, interline transfer, type SONY ICX442AQ |

| **Specification** | **PicSight P133B-Smart502** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1304 × 976 pixels |
| Full sensor resolution (incl. black pixels) | 1360 × 986 pixels |
| Frame rate | 8.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 0 × 0 µm |
| Sensor size (H×V) | 6.23 × 5.09 mm |
| Shutter | global, 5 µs –60000 ms (default 100 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -10 .. 26 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P133B-Smart502 |
|---|---|
| Ordering information | • 151602: PicSight P133B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 151603: PicSight P133B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 151627: PicSight P133B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 151628: PicSight P133B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.5. PicSight P133B-Smart502 technical specifications*

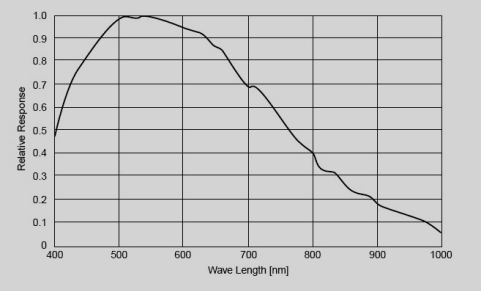
# B.6. PicSight P141B-Smart502

| Specification | PicSight P141B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 2/3" CCD, interline transfer, type SONY ICX285 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1392 × 1040 pixels |
| Full sensor resolution (incl. black pixels) | 1438 × 1050 pixels |
| Frame rate | 20.2 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 6.45 × 6.45 µm |
| Sensor size (H×V) | 10.2 × 8.3 mm |
| Shutter | global, 5 µs –60000 ms (default 48 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P141B-Smart502 |
|---|---|
| Gain & black level | • Analog gain: -3 .. 33 dB (default 9 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 181602: PicSight P141B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 181603: PicSight P141B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 181627: PicSight P141B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 181628: PicSight P141B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.6. PicSight P141B-Smart502 technical specifications*

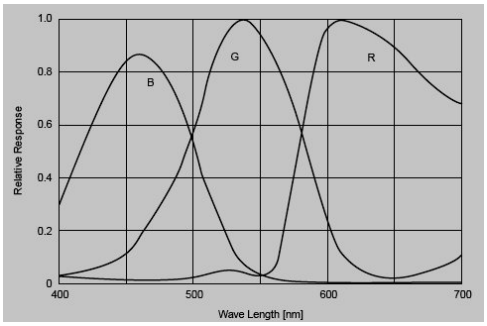
# B.7. PicSight P141M-Smart502

| Specification | PicSight P141M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 2/3" CCD, interline transfer, type SONY ICX285 |
| Spectral sensitivity |  |

| Specification | PicSight P141M-Smart502 |
|---|---|
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 1392 × 1040 pixels |
| Full sensor resolution (incl. black pixels) | 1438 × 1050 pixels |
| Frame rate | 20.2 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 6.45 × 6.45 µm |
| Sensor size (H×V) | 10.2 × 8.3 mm |
| Shutter | global, 5 µs –60000 ms (default 48 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -3 .. 33 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 43 dB |
| Dynamic range | 77 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 180602: PicSight P141M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 180603: PicSight P141M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 180627: PicSight P141M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 180628: PicSight P141M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.7. PicSight P141M-Smart502 technical specifications*

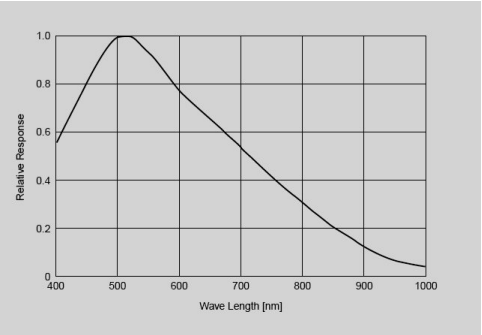
# B.8. PicSight P142AB-Smart502

| Specification | PicSight P142AB-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX267 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1392 × 1040 pixels |
| Full sensor resolution (incl. black pixels) | 1434 × 1050 pixels |
| Frame rate | 0.15 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.65 × 4.65 µm |
| Sensor size (H×V) | 7.6 × 6.2 mm |
| Shutter | global, 5 µs –60000 ms (default 130 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -8 .. 28 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P142AB-Smart502 |
|---|---|
| Ordering information | • 171602: PicSight P142AB-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 171603: PicSight P142AB-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 171627: PicSight P142AB-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 171628: PicSight P142AB-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.8. PicSight P142AB-Smart502 technical specifications*

# B.9. PicSight P142AM-Smart502

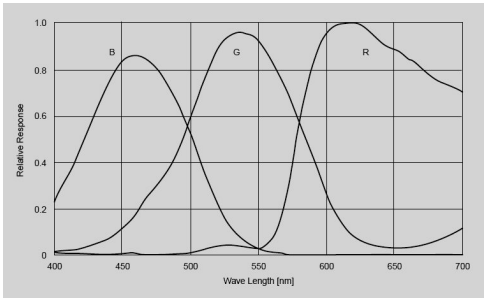
| Specification | PicSight P142AM-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX267 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 1392 × 1040 pixels |
| Full sensor resolution (incl. black pixels) | 1434 × 1050 pixels |
| Frame rate | 0.15 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.65 × 4.65 µm |
| Sensor size (H×V) | 7.6 × 6.2 mm |
| Shutter | global, 5 µs –60000 ms (default 50 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P142AM-Smart502 |
|---|---|
| Gain & black level | • Analog gain: -8 .. 28 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 43 dB |
| Dynamic range | 71 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 170602: PicSight P142AM-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 170603: PicSight P142AM-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 170627: PicSight P142AM-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 170628: PicSight P142AM-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.9. PicSight P142AM-Smart502 technical specifications*

# B.10. PicSight P202B-Smart502

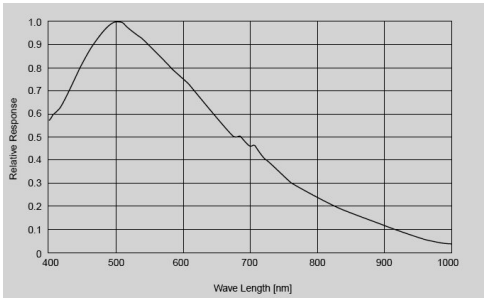
| Specification | PicSight P202B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/1.8" CCD, interline transfer, type SONY ICX274 |

| **Specification** | **PicSight P202B-Smart502** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1624 × 1236 pixels |
| Full sensor resolution (incl. black pixels) | 1688 × 1248 pixels |
| Frame rate | 14.6 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.4 × 4.4 µm |
| Sensor size (H×V) | 8.5 × 6.8 mm |
| Shutter | global, 5 µs –60000 ms (default 60 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -10 .. 26 dB (default 4 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P202B-Smart502 |
|---|---|
| Ordering information | • 211602: PicSight P202B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 211603: PicSight P202B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 211627: PicSight P202B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 211628: PicSight P202B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.10. PicSight P202B-Smart502 technical specifications*

# B.11. PicSight P202M-Smart502

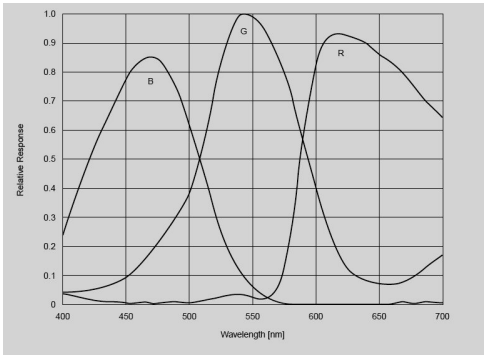
| Specification | PicSight P202M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/1.8" CCD, interline transfer, type SONY ICX274 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 1624 × 1236 pixels |
| Full sensor resolution (incl. black pixels) | 1688 × 1248 pixels |
| Frame rate | 14.6 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.4 × 4.4 µm |
| Sensor size (H×V) | 8.5 × 6.8 mm |
| Shutter | global, 5 µs –60000 ms (default 30 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P202M-Smart502 |
|---|---|
| Gain & black level | • Analog gain: -10 .. 26 dB (default 0 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 40 dB |
| Dynamic range | 69 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 210602: PicSight P202M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 210603: PicSight P202M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 210627: PicSight P202M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 210628: PicSight P202M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.11. PicSight P202M-Smart502 technical specifications*

# B.12. PicSight P203B-Smart502

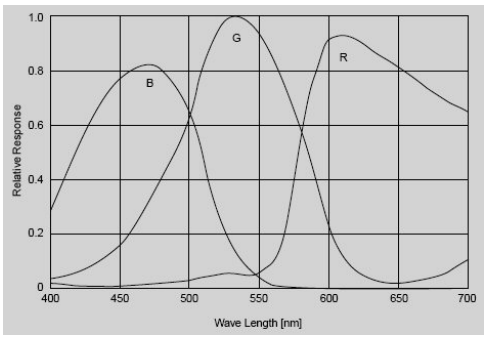
| Specification | PicSight P203B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/1" CCD, interline transfer, type SONY ICX454JQF-J |

| **Specification** | **PicSight P203B-Smart502** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1648 × 1240 pixels |
| Full sensor resolution (incl. black pixels) | 1690 × 1250 pixels |
| Frame rate | 9.2 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 0 × 0 µm |
| Sensor size (H×V) | 6.38 × 5.26 mm |
| Shutter | global, 5 µs –60000 ms (default 100 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -6 .. 26 dB (default 6 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P203B-Smart502 |
|---|---|
| Ordering information | • 201602: PicSight P203B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 201603: PicSight P203B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 201627: PicSight P203B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 201628: PicSight P203B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.12. PicSight P203B-Smart502 technical specifications*

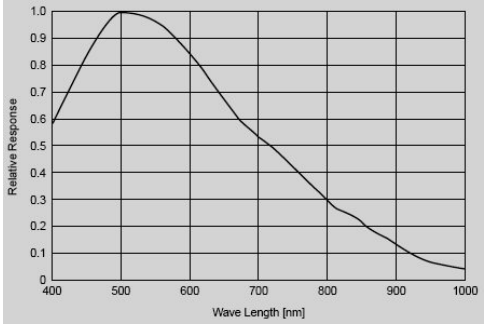
# B.13. PicSight P32B-Smart502

| Specification | PicSight P32B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX414 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 9.9 × 9.9 µm |
| Sensor size (H×V) | 7.48 × 6.15 mm |
| Shutter | global, 5 µs –60000 ms (default 16 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P32B-Smart502 |
|---|---|
| Gain & black level | • Analog gain: -6 .. 30 dB (default 10 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 121602: PicSight P32B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 121603: PicSight P32B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 121627: PicSight P32B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 121628: PicSight P32B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.13. PicSight P32B-Smart502 technical specifications*

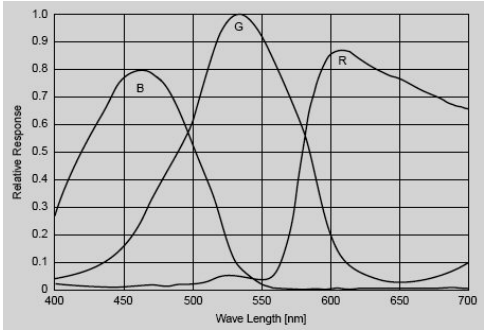
# B.14. PicSight P32M-Smart502

| Specification | PicSight P32M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX414 |
| Spectral sensitivity |  |

| Specification | PicSight P32M-Smart502 |
|---|---|
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 9.9 × 9.9 µm |
| Sensor size (H×V) | 7.48 × 6.15 mm |
| Shutter | global, 5 µs –60000 ms (default 16 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -6 .. 30 dB (default 4 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 45 dB |
| Dynamic range | 73 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 120602: PicSight P32M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 120603: PicSight P32M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 120627: PicSight P32M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 120628: PicSight P32M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.14. PicSight P32M-Smart502 technical specifications*

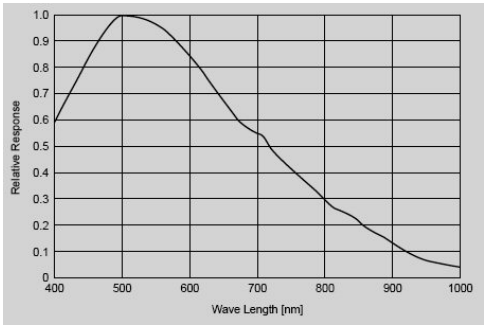
# B.15. PicSight P33B-Smart502

| Specification | PicSight P33B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/3" CCD, interline transfer, type SONY ICX424 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 7.4 × 7.4 µm |
| Sensor size (H×V) | 5.79 × 4.89 mm |
| Shutter | global, 5 µs –60000 ms (default 16 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -6 .. 30 dB (default 12 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P33B-Smart502 |
|---|---|
| Ordering information | • 111602: PicSight P33B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 111603: PicSight P33B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 111627: PicSight P33B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 111628: PicSight P33B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.15. PicSight P33B-Smart502 technical specifications*

# B.16. PicSight P33M-Smart502

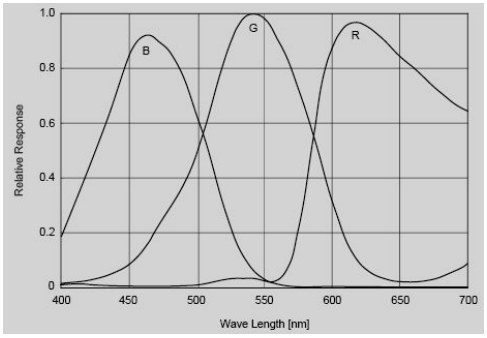
| Specification | PicSight P33M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/3" CCD, interline transfer, type SONY ICX424 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 7.4 × 7.4 µm |
| Sensor size (H×V) | 5.79 × 4.89 mm |
| Shutter | global, 5 µs –60000 ms (default 16 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P33M-Smart502 |
|---|---|
| Gain & black level | • Analog gain: -6 .. 30 dB (default 4 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 40 dB |
| Dynamic range | 63 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 110602: PicSight P33M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 110603: PicSight P33M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 110627: PicSight P33M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 110628: PicSight P33M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.16. PicSight P33M-Smart502 technical specifications*

# B.17. PicSight P34B-Smart502

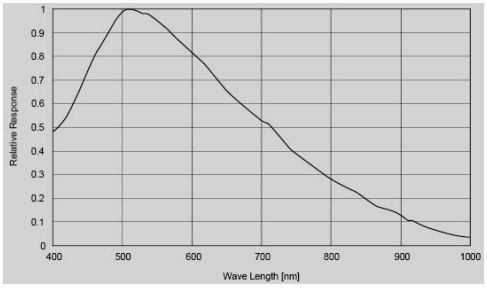
| Specification | PicSight P34B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/4" CCD, interline transfer, type SONY ICX098 |

| **Specification** | **PicSight P34B-Smart502** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 64.7 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 5.6 × 5.6 µm |
| Sensor size (H×V) | 4.6 × 3.97 mm |
| Shutter | global, 5 µs –60000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -6 .. 30 dB (default 16 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P34B-Smart502 |
|---|---|
| Ordering information | • 101602: PicSight P34B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 101603: PicSight P34B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 101627: PicSight P34B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 101628: PicSight P34B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.17. PicSight P34B-Smart502 technical specifications*

# B.18. PicSight P34M-Smart502

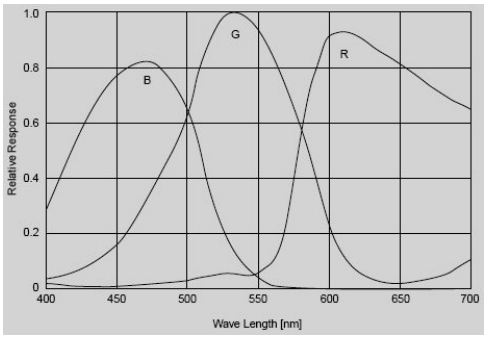
| Specification | PicSight P34M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/4" CCD, interline transfer, type SONY ICX098 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 656 × 492 pixels |
| Full sensor resolution (incl. black pixels) | 692 × 504 pixels |
| Frame rate | 64.7 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 5.6 × 5.6 µm |
| Sensor size (H×V) | 4.6 × 3.97 mm |
| Shutter | global, 5 µs –60000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P34M-Smart502 |
|---|---|
| Gain & black level | • Analog gain: -6 .. 30 dB (default 9 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 44 dB |
| Dynamic range | 69 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 100602: PicSight P34M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 100603: PicSight P34M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 100627: PicSight P34M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 100628: PicSight P34M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.18. PicSight P34M-Smart502 technical specifications*

# B.19. PicSight P52B-Smart502

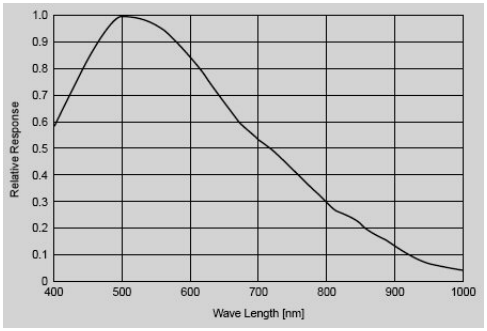
| Specification | PicSight P52B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX415 |

| Specification | PicSight P52B-Smart502 |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 776 × 580 pixels |
| Full sensor resolution (incl. black pixels) | 823 × 592 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 8.3 × 8.3 µm |
| Sensor size (H×V) | 7.48 × 6.15 mm |
| Shutter | global, 5 µs –60000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -10 .. 26 dB (default 12 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P52B-Smart502 |
|---|---|
| Ordering information | • 131602: PicSight P52B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 131603: PicSight P52B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 131627: PicSight P52B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 131628: PicSight P52B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.19. PicSight P52B-Smart502 technical specifications*

# B.20. PicSight P52M-Smart502

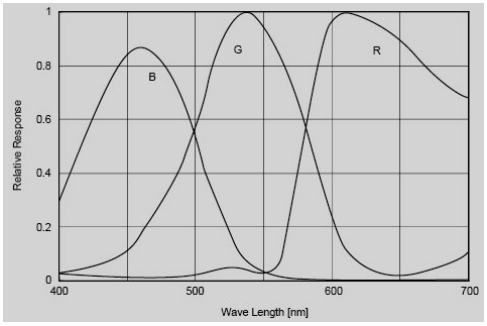
| Specification | PicSight P52M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CCD, interline transfer, type SONY ICX415 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 776 × 580 pixels |
| Full sensor resolution (incl. black pixels) | 823 × 592 pixels |
| Frame rate | 62.3 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 8.3 × 8.3 µm |
| Sensor size (H×V) | 7.48 × 6.15 mm |
| Shutter | global, 5 µs –60000 ms (default 15 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P52M-Smart502 |
|---|---|
| Gain & black level | • Analog gain: -10 .. 26 dB (default 4 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 44 dB |
| Dynamic range | 69 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 130602: PicSight P52M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 130603: PicSight P52M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 130627: PicSight P52M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 130628: PicSight P52M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.20. PicSight P52M-Smart502 technical specifications*

# B.21. PicSight P83B-Smart502

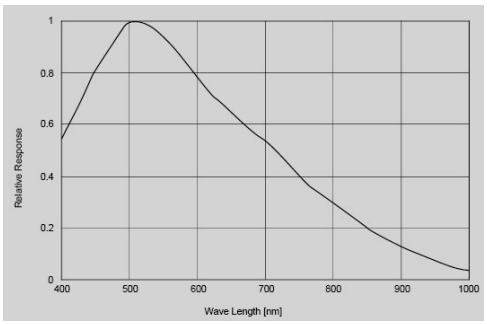
| Specification | PicSight P83B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/3" CCD, interline transfer, type SONY ICX204 |

| **Specification** | **PicSight P83B-Smart502** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 1032 × 776 pixels |
| Full sensor resolution (incl. black pixels) | 1077 × 788 pixels |
| Frame rate | 32.5 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.65 × 4.65 µm |
| Sensor size (H×V) | 5.8 × 4.92 mm |
| Shutter | global, 5 µs –60000 ms (default 30 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |
| Gain & black level | • Analog gain: -8 .. 28 dB (default 16 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight P83B-Smart502 |
|---|---|
| Ordering information | • 141602: PicSight P83B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 141603: PicSight P83B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 141627: PicSight P83B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 141628: PicSight P83B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.21. PicSight P83B-Smart502 technical specifications*

# B.22. PicSight P83M-Smart502

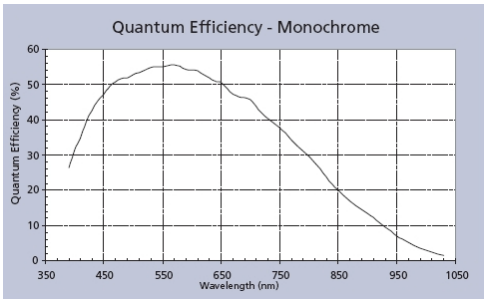
| Specification | PicSight P83M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/3" CCD, interline transfer, type SONY ICX204 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 1032 × 776 pixels |
| Full sensor resolution (incl. black pixels) | 1077 × 788 pixels |
| Frame rate | 32.5 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 4.65 × 4.65 µm |
| Sensor size (H×V) | 5.8 × 4.92 mm |
| Shutter | global, 5 µs –60000 ms (default 30 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Long range exposure mode |

| Specification | PicSight P83M-Smart502 |
|---|---|
| Gain & black level | • Analog gain: -8 .. 28 dB (default 14 dB)<br>• Digital gain: n/a<br>• Black level: 0 .. 25.5 DN (default 0 DN) |
| Auto functions | n/a |
| Signal/noise ratio | 42 dB |
| Dynamic range | 73 dB |
| Area of interest (AOI) | Vertical AOI applicable directly at the sensor |
| Binning | • Vertical: 2× |
| Decimation | n/a |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 140602: PicSight P83M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 140603: PicSight P83M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 140627: PicSight P83M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 140628: PicSight P83M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.22. PicSight P83M-Smart502 technical specifications*

# B.23. PicSight R132M-Smart502

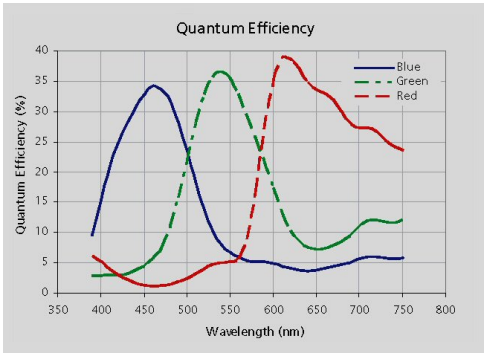
| Specification | PicSight R132M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CMOS, sequential readout, type Aptina MT9M001 |

| **Specification** | **PicSight R132M-Smart502** |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | monochrom |
| Output image resolution (H×V) | 1280 × 1024 pixels |
| Frame rate | 30 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 5.2 × 5.2 µm |
| Sensor size (H×V) | 6.66 × 5.32 mm |
| Shutter | rolling, 28 µs –520 ms (default 30 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |
| Gain & black level | • Analog gain: 0 .. 23.53 dB (default 14 dB)<br>• Digital gain: n/a<br>• Black level: -51.2 .. 51 DN (default 0 DN) |
| Auto functions | • Automatic black level |
| Signal/noise ratio | 42 dB |
| Dynamic range | 52 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | n/a |
| Decimation | • Horizontal: 2× 4× 8×<br>• Vertical: 2× 4× 8× |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight R132M-Smart502 |
|---|---|
| Ordering information | • 420602: PicSight R132M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 420603: PicSight R132M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 420627: PicSight R132M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 420628: PicSight R132M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.23. PicSight R132M-Smart502 technical specifications*

# B.24. PicSight R312AB-Smart502

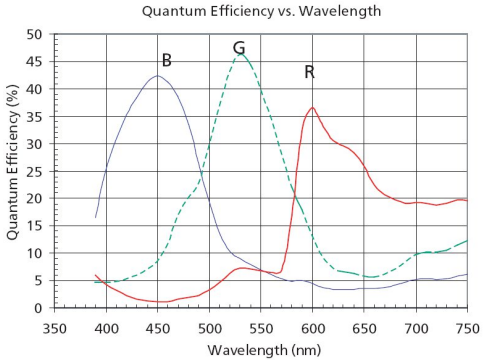
| Specification | PicSight R312AB-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2" CMOS, sequential readout, type Aptina MT9T001 |
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 2048 × 1536 pixels |
| Frame rate | 12.77 fps |
| Video format | 10-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 3.2 × 3.2 µm |
| Sensor size (H×V) | 6.5536 × 4.9152 mm |
| Shutter | rolling, 47 µs –520 ms (default 10 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode |
| Gain & black level | • Analog gain: 0 .. 18.07 dB (default 18 dB)<br>• Digital gain: 0 .. 24.08 dB (default 0 dB)<br>• Black level: -51.2 .. 51 DN (default 0 DN) |

| Specification | PicSight R312AB-Smart502 |
|---|---|
| Auto functions | • Automatic black level |
| Signal/noise ratio | 43 dB |
| Dynamic range | 61 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | • Horizontal: 2× 3×<br>• Vertical: 2× 3× |
| Decimation | • Horizontal: 2× 3× 4× 8×<br>• Vertical: 2× 3× 4× 8× |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 441602: PicSight R312AB-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 441603: PicSight R312AB-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 441627: PicSight R312AB-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 441628: PicSight R312AB-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.24. PicSight R312AB-Smart502 technical specifications*

# B.25. PicSight R502B-Smart502

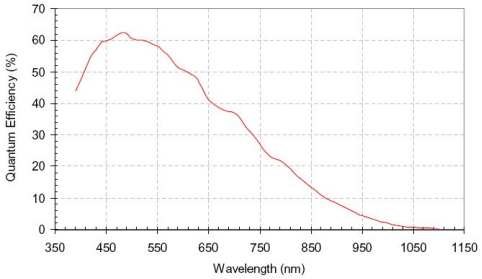
| Specification | PicSight R502B-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2.5" CMOS, sequential readout, type Aptina MT9P031 |

| Specification | PicSight R502B-Smart502 |
|---|---|
| Spectral sensitivity |  |
| Monochrome/color | bayer pattern |
| Output image resolution (H×V) | 2592 × 1944 pixels |
| Frame rate | 11.7 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 2.2 × 2.2 µm |
| Sensor size (H×V) | 5.702 × 4.277 mm |
| Shutter | rolling, 39 µs –55000 ms (default 10 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Global reset mode |
| Gain & black level | • Analog gain: 0 .. 18.06 dB (default 0 dB)<br>• Digital gain: 0 .. 24.08 dB (default 0 dB)<br>• Black level: 0 .. 2.55 DN (default 0 DN) |
| Auto functions | • Automatic black level |
| Signal/noise ratio | 38 dB |
| Dynamic range | 70 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | • Horizontal: 2× 4×<br>• Vertical: 2× 4× |
| Decimation | • Horizontal: 2× 3× 4× 5× 6× 7×<br>• Vertical: 2× 3× 4× 5× 6× 7× 8× |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |

| Specification | PicSight R502B-Smart502 |
|---|---|
| Ordering information | • 451602: PicSight R502B-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 451603: PicSight R502B-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 451627: PicSight R502B-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 451628: PicSight R502B-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.25. PicSight R502B-Smart502 technical specifications*

# B.26. PicSight R502M-Smart502

| Specification | PicSight R502M-Smart502 |
|---|---|
| Interface | Ethernet 1000/100/10 Mb/s |
| Smart technology | 32-bit RISC VLIW processor PNX1502/300MHz, 64MB DDR2 RAM (128MB on newer and all currently delivered systems), 32MB flash memory for user applications, real-time operating system, C/C++ compiler, various APIs |
| Sensor | 1/2.5" CMOS, sequential readout, type Aptina MT9P031 |
| Spectral sensitivity |  |
| Monochrome/color | monochrome |
| Output image resolution (H×V) | 2592 × 1944 pixels |
| Frame rate | 11.7 fps |
| Video format | 12-bit, single tap |
| Scanning | progressive |
| Pixel size (H×V) | 2.2 × 2.2 µm |
| Sensor size (H×V) | 5.702 × 4.277 mm |
| Shutter | rolling, 39 µs –55000 ms (default 10 ms) |
| Operating (trigger) modes | • Free running<br>• Triggered mode<br>• Global reset mode |
| Gain & black level | • Analog gain: 0 .. 18.06 dB (default 0 dB)<br>• Digital gain: 0 .. 24.08 dB (default 0 dB)<br>• Black level: 0 .. 2.55 DN (default 0 DN) |

| Specification | PicSight R502M-Smart502 |
|---|---|
| Auto functions | • Automatic black level |
| Signal/noise ratio | 38 dB |
| Dynamic range | 70 dB |
| Area of interest (AOI) | Horizontal and vertical AOI applicable directly at the sensor |
| Binning | • Horizontal: 2× 4×<br>• Vertical: 2× 4× |
| Decimation | • Horizontal: 2× 3× 4× 5× 6× 7×<br>• Vertical: 2× 3× 4× 5× 6× 7× 8× |
| Mount | C-mount (CS-mount on request) |
| Dimension | • 44.8×31.4×91.7 mm (W×H×L, without connectors) — standard version<br>• 44.8×37.56×96.0 mm (W×H×L, without connectors) — right angle version |
| Weight | 145 g |
| Power input | 10-26V/5W |
| Ordering information | • 450602: PicSight R502M-Smart502-AS (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 450603: PicSight R502M-Smart502-AS-H (PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br>• 450627: PicSight R502M-Smart502-PoE-S (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector)<br>• 450628: PicSight R502M-Smart502-PoE-S-H (PoE, PNX1502, 300MHz, 64MB-DDR, lens controller, Hirose/SDR-26 connector, 90° lens mount)<br><br>Check latest price list or contact us to learn if more options are available. |

*Table B.26. PicSight R502M-Smart502 technical specifications*

# Contacting Leutron Vision

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## Other countries

Customers residing in other countries should have a look at the list of our representatives[3] for a distributor in their country. If no distributor exists in their country, they should contact the headquarter office directly.

## Useful links

- To download software, documentation and other stuff, please visit our download area[4].
- Get more information about our support[5]. If you need to return some (defective) material to Leutron Vision, please visit the Return Material Authorization (RMA) page[6].
- Get information about prices and ordering[7].
- Find out detailed information about our hardware and software product range[8].

[1] http://www.leutron.com/
[2] http://www.leutron.com/de/
[3] http://www.leutron.com/sales-contact/
[4] http://www.leutron.com/support-downloads/download-area/
[5] http://www.leutron.com/support-downloads/
[6] http://www.leutron.com/rma/client_id.php
[7] http://www.leutron.com/price-request/
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